NOVEMBER 1956

TOOLING and PRODUCTION

The Magazine of Manufacturing Management

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DESIGNED FOR THE MACHINIST'S TOOL BOX

Here's a catalog that exactly fits in a machinist's tool box in more ways than one. Not only are the Putnam Catalog physical dimensions exactly proportioned to fit within standard tool boxes so that it will always be handy, but, conveniently listed and illustrated within the Putnam Catalog are over 1400 different types and sizes of standard end mills.

Because at Putnam we specialize in the manufacture of end mills, you will find more standard sizes and types listed in this catalog than can be found in any other. Thus, on nearly every milling job you will find the quick and convenient answer to your end mill requirements right in your own tool box—in the Putnam Catalog.

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PUTNAM TOOL COMPANY
2981 CHARLEVOIX AVENUE · DETROIT 7, MICHIGAN

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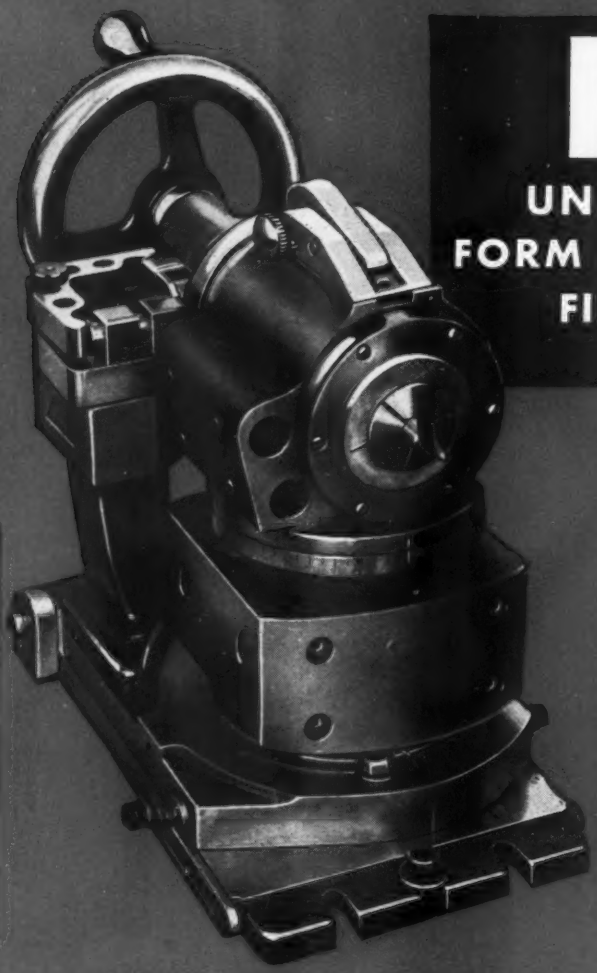
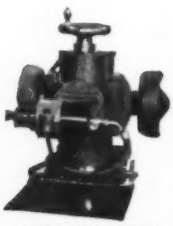
UNIVERSAL FORM RELIEVING FIXTURE

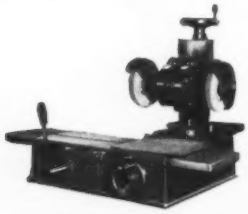


The Biggest Improvement in Years in Cutting Tools has been in the Method of Sharpening Them



INTERNAL ATTACHMENT

MOTORIZED MODEL



R-O GRINDER

BASE FOR GRINDER

Form ground relief is stepping up cutter life by as much as 200% and replacing old style angular cutting edge relief on thousands of jobs in metalworking plants across the country. Why is it better?

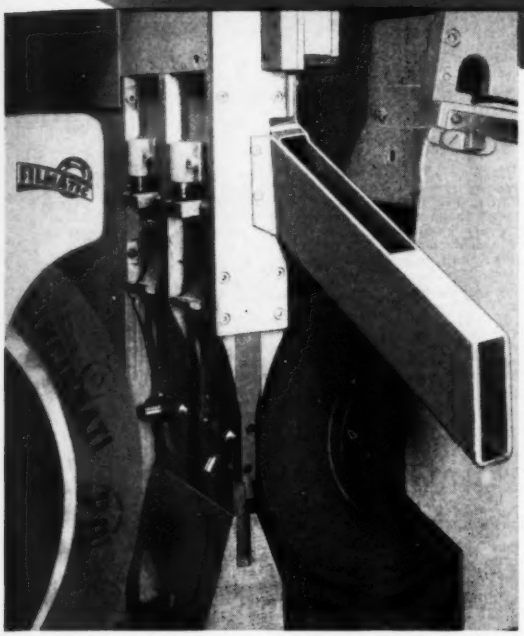
(1) Leaves maximum metal behind the edge to dissipate heat and eliminate galling (2) Relieves from the edge back, leaving no feather edge to break down and dull after a few cuts (3) Eliminates undercutting at intersections and burrs on the work. How much could this type sharpening save per year in your plant?

Write for the R-O catalog, today

GRINDER DIVISION
ROYAL OAK TOOL & MACHINE CO.
29800 Stephenson Highway
ROYAL OAK, MICHIGAN

Unique Transfer Idea Solved This Problem:

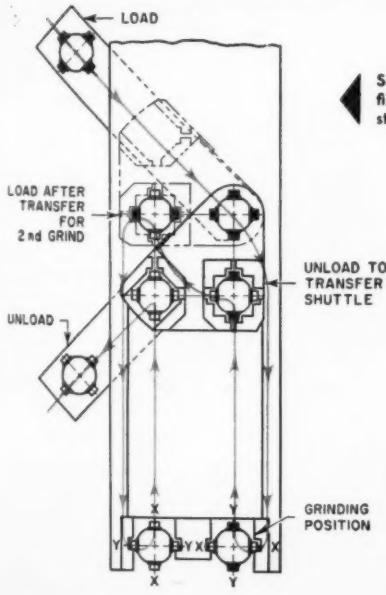
Automatically Grind Four Diameters of Universal Joint Spiders In One Cycle



Two universal joint spiders are in process at the same time, grinding two pin diameters on each of two parts. Estimated production, 300 completed parts per hour.

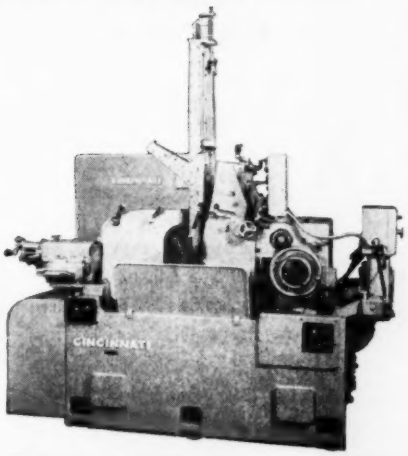
Everyone familiar with universal joint spiders will agree that it's a neat trick to automatically grind the two pin diameters on each of two parts at the same time. Cincinnati automation specialists devised a way to do the job on a new CINCINNATI® FILMATIC No. 2 Centerless Grinder. A unique transfer mechanism, incorporated in the loading fixture developed by Cincinnati for the machine, was the key to this low-cost method of production. Principle of operation is diagramed below at the left. ¶ The manufacture of universal joint spiders may not be your line of work, but some type of precision cylindrical grinding is required in your shop, and Cincinnati grinding and automation specialists can help you do a better job at lower cost. You can be sure that these men will give you the benefit of the most advanced thinking in centerless grinding methods, backed up by 33 years' experience. May we hear from you?

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO



Schematic drawing of loading and transfer fixture. Parts are ground on axis X in one station, and axis Y in the other.

CINCINNATI FILMATIC No. 2 Centerless Grinder, equipped to automatically grind universal joint spiders. You will find brief information on the standard No. 2 machine in Sweet's Machine Tool File. For complete data, write for catalog No. G-644-1.



CINCINNATI

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES
CENTERLESS LAPPING MACHINES • MICRO-CENTRIC GRINDING MACHINES

CIRCLE INFORM-A-GRAM KEY NO. 3

CIRCLE INFORM-A-GRAM KEY NO. 4

TOOLING and PRODUCTION

The Magazine of Manufacturing Management

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VOL. XXII—No. 1
NOVEMBER 1956

GEORGE J. HUEBNER, Founder

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TOOLING and PRODUCTION'S great appeal is to those men who operate the plants and divisions of industry, their production departments and their toolrooms. It is they who collectively are charged with the responsibility of manufacturing their companies' products precisely, efficiently and profitably.

They have the influence that enables them to adopt the ideas and the processes which TOOLING and PRODUCTION describes in every issue AND the authority to recommend, to specify and/or to buy everything that may be needed to reduce costs, increase production or improve quality. These men for whom, each month our editors seek out or write TOOLING and PRODUCTION'S meticulously accurate stories of "Know-How" and "Tell-How" are T & P's exclusive Cycle of Buying Influence (CBI) in their plants.

Every copy is directed to these men by name, by title and by company address. Please see our BPA verification.

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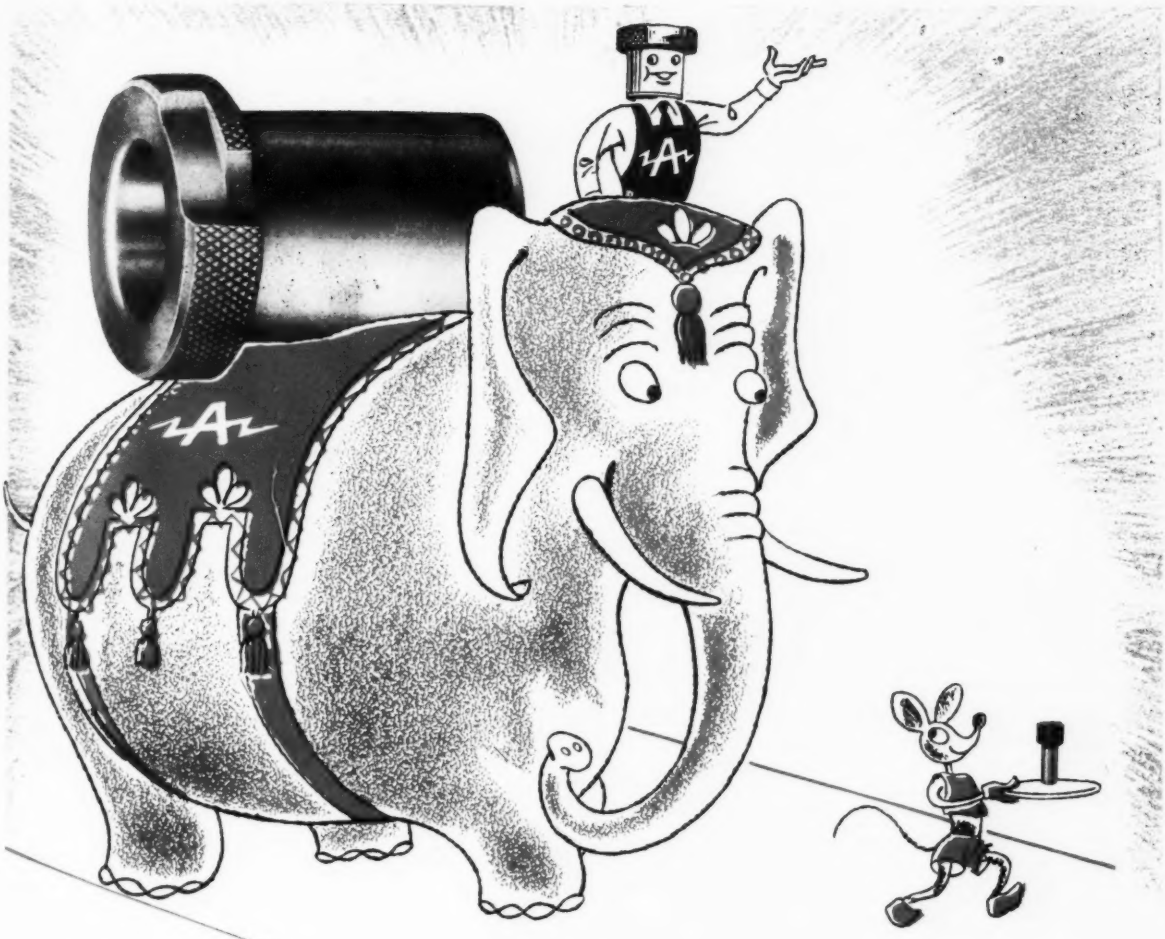

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61 models

A machine not put to its best use is theoretically idle. Proper machine selection is an important factor in the profitable use of a multiple spindle automatic. So extensive are the demands on this type of lathe that no single model—or number of models—can be expected to efficiently handle the wide range of work available.

To excel in any range of work a multiple spindle automatic must be specifically designed for that range. That is why CONOMATICS are provided in so many models. In no other way can the purchaser be assured of the best possible machine for his particular requirements.

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KWIK-CHEK gages adjust instantly to any diameter reading from .025" to .380" . . . accurate to .0005" . . . and lock at *precise* diameter readings.

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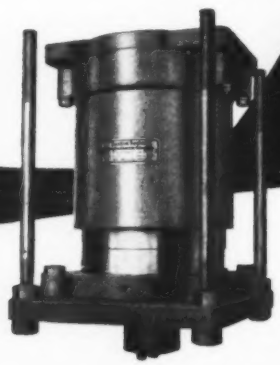
Universal Pneumatic

DIE CUSHIONS

- High and low pressure cushions —bolster or press bed mounting—for any punch press.
- Bronze overlay on piston surfaces for maximum wear.
- All welded steel construction.
- Internally guided with oversize cylinder rod to compensate for off-center loading.
- "One shot" lubrication.
- Available from stock from 3" dia., ½-ton capacity to 24" dia., 45-ton capacity.

NEW! MODEL HD ADJUSTABLE DIE CUSHION!

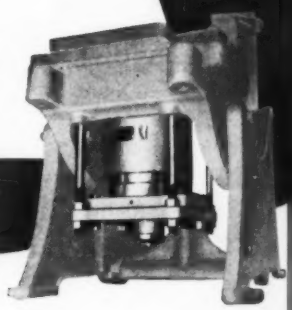
A Dayton Rogers Exclusive! An all steel, high pressure (200 PSI) adjustable die cushion with a bronze overlay on the piston surface to give the maximum in wear! Features an internally guided, oversize cylinder rod to compensate for off-center loading. "One shot" lubrication. Available from stock in five sizes from 8" diameter, 5-ton capacity to 16" diameter, 20-ton capacity.



Specify

DAYTON ROGERS

Universal Pneumatic
DIE CUSHIONS FOR COMPOUND BLANKING, PIERCING, FORMING & DRAWING OPERATIONS.
... Special Die Cushions Available for Practically Any Power Press.
... Engineering Service at Your Disposal.

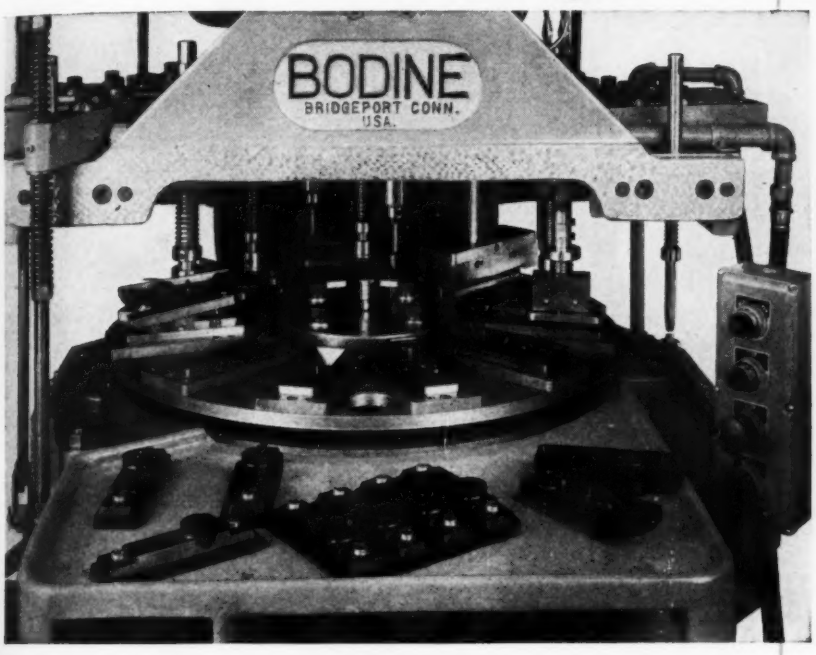


FREE! Write For Folder "High Pressure Die Cushions."

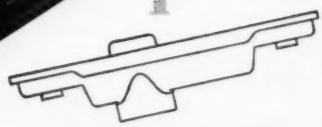
DAYTON ROGERS
Manufacturing Company
MINNEAPOLIS 7B MINNESOTA

Bodine CASE HISTORY NO. 41

MULTIPLE OPERATIONS . . .
MULTIPLE TOOLING . . .
METAL AND PLASTIC . . .
ON ONE VERSATILE MACHINE

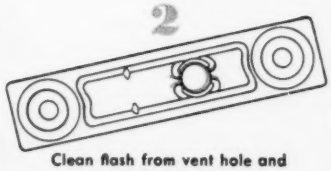


1



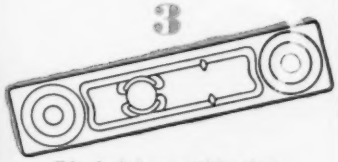
Covers hand-loaded, one piece per stroke.

2



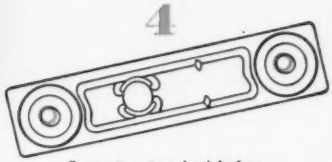
Clean flash from vent hole and slots. Carbide tools.

3



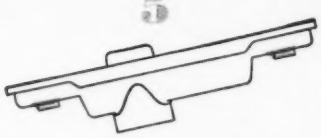
Trim flash from outside edges of cover. Carbide tools.

4



Ream two terminal holes in lead inserts.

5



Hollow-mill two terminals in lead inserts . . . using inverted spindles.

6

AUTO EJECT.

The unusual features of this Bodine tooling lie in the many different types of operations performed in one high-speed cycle, and also in the multiple tooling of the machine to handle many different sizes of these auto battery cell covers, both 6-volt and 12-volt.

Major battery producers now use 15 of these production units. Bodine basic design, as will be seen in the photograph, provides ample room for inclusion of the dies required for trimming operations, as well as the rotary spindles.

PRODUCTION: 1,250 covers per 50-minute hour . . . with machine operating at 25 strokes per minute.

If you are looking for increased output at lower cost, without sacrifice of quality . . . on assembly or production operations, or a combination of both . . . talk to Bodine first. Our experience can save you money and costly engineering.

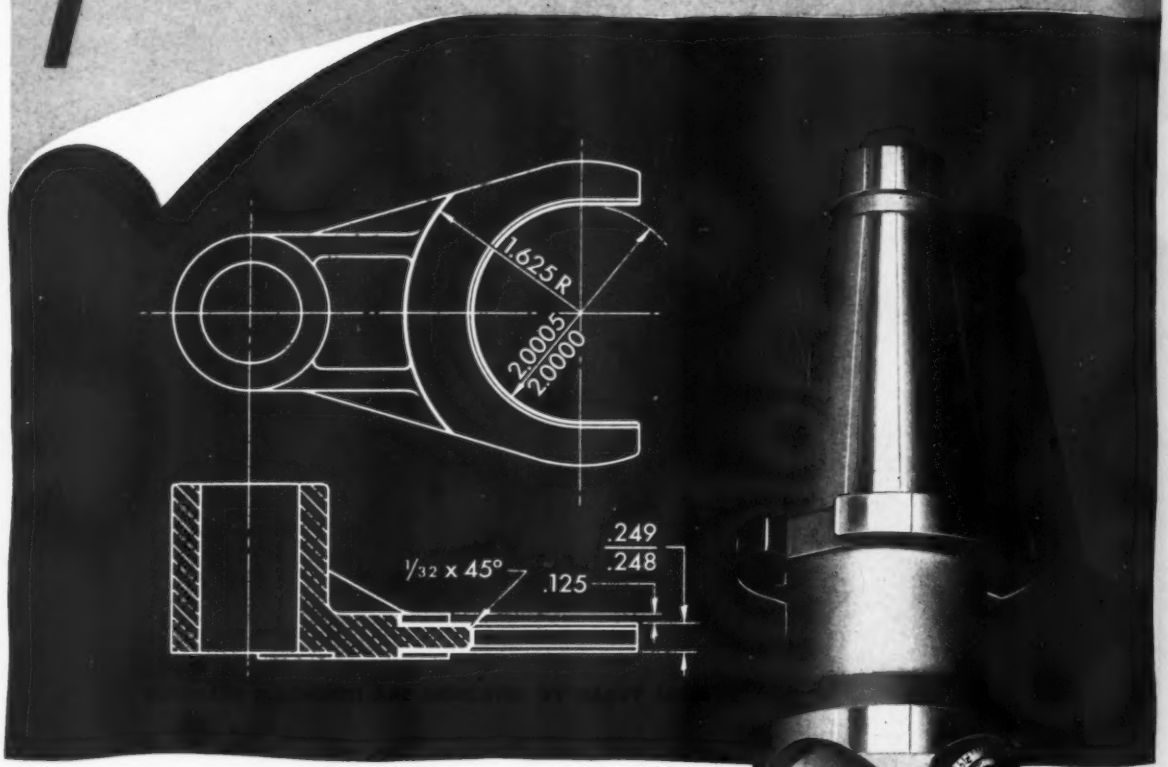
Write Dept. TP-11.

THE Bodine CORPORATION
BRIDGEPORT 5, CONNECTICUT
AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

78D88

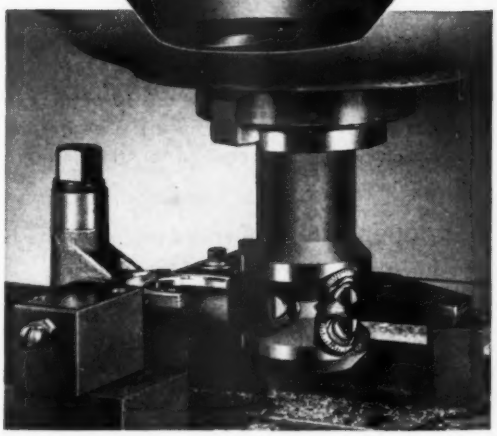
CIRCLE INFORM-A-GRAM KEY NO. 9

7 SURFACES on SHIFTER FORK MACHINED AT 1 PASS!



And held to precise limits by using MICROBORE® Precision Tooling-

Illustration shows setup for completely machining shifter forks on standard Vertical Milling Machine to precise limits of accuracy on a production basis. This application of Microbore Cluster Tooling permits use of simple low-cost work holding fixture, and substantially reduces tool costs per piece.



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Microbore®
PRECISION TOOLING

DEVLIEG MICROBORE
DIVISION OF DEVLIEG MACHINE COMPANY
2720 West Fourteen Mile Rd. • Royal Oak, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 10

MAGNESIUM for low cost tooling

MAGNESIUM *machinability beats tight schedules*

Machinability and handling ease are two reasons Carr Lane moves jobs faster, at lower cost, with magnesium tooling plate

When a job has to be completed in a hurry, which is often the case at Carr Lane Manufacturing Company, St. Louis, there are big advantages in using magnesium tooling plate.

FASTER MACHINING. Production operations go faster because magnesium jigs and fixtures are easy to machine, easy to weld. Excellent dimensional stability and precision flatness help to hold the closest tolerances. These properties also help to save many hours in the process. On the fixture illustrated, it would take twice as long to do the job in aluminum—and ten times as long in steel.

FASTER HANDLING. The light weight of magnesium, two-thirds that of aluminum, permits pieces to be handled and moved from one operation to another with a minimum of time, effort and equipment. This is particularly important with large jigs and fixtures which couldn't be handled manually if they were made of steel.

FASTER AVAILABILITY. You can get magnesium tooling plate when you want it and how you want it. Whether production deadlines are tight or not, it's always readily obtainable in any standard size and gauge from stock. Contact your nearest supplier of Dow Magnesium or write to THE DOW CHEMICAL COMPANY, Midland, Michigan, Dept. MA 372AA.

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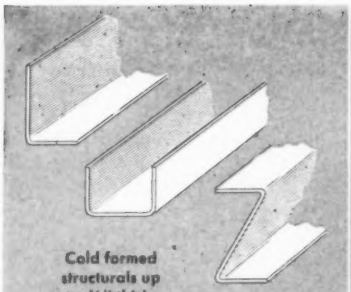
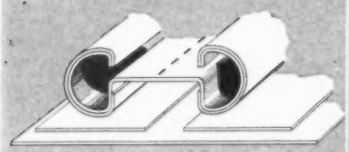
you can depend on DOW MAGNESIUM DOW

CIRCLE INFORM-A-GRAM KEY NO. 11

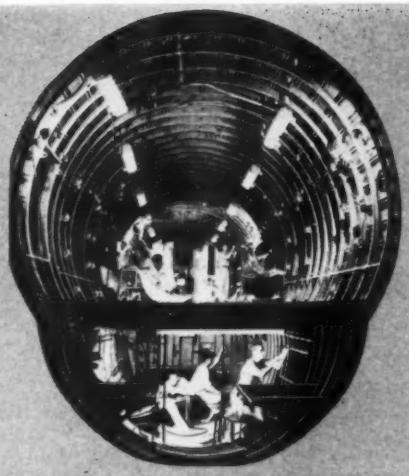


Cold formed structurals up to ½" thick.



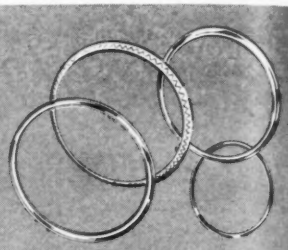
Two or three strips of different materials combined and slit into two identical or different shapes.

Raceway conduit mouldings by Wiremold Co., Hartford, Conn.

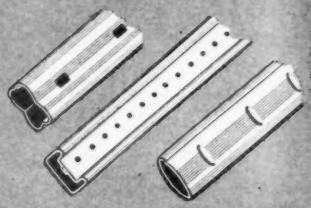


Cold Roll Formed curved ribs and other structurals used in airplanes, metal buildings, etc.

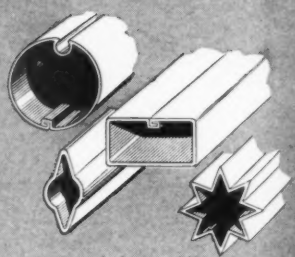
Metal awnings, rolling doors, etc., made from interlocking roll formed slats.



Rings of any size, for a multitude of different uses.



Roll-formed shapes, notched, perforated, indented or embossed.



Lockseam tubular mouldings, in many styles and shapes.

1001 Things Now Being Done By COLD ROLL FORMING

• The basic function of a Yoder cold roll forming machine is, of course, to convert flat rolled strip or sheets at high speed into mouldings, panels, tubular, channel and other shapes.

Quite often, these shapes need further elaboration before being ready for assembly or installation. They may, for instance, have to be curved, coiled or made into rings. Or they may need to be perforated at certain intervals of spacing, notched, embossed, or otherwise finished by additional operations. You may want to combine two or more materials into a finished shape, such as carbon steel with stainless, felt, wood, etc.

These and many other things can be done with Yoder machines at little or no extra cost over and above normal conversion costs, simply by providing special attachments, or by auxiliary units installed in line with the forming mill.

So, to the recognized high economy of the cold forming operation itself, other important production economies may be added. Yoder engineers are at your service in designing equipment of this kind.

The Yoder Book on Cold Roll Forming is a complete text, profusely illustrated, on the art and its scope, the machines, their tooling and application to a multiplicity of mass production needs. A copy is yours for the asking.

THE YODER COMPANY • 5501 Walworth Ave., Cleveland 2, Ohio

ENGINEERING YODER MANUFACTURING

COLD ROLL FORMING MACHINES
ROTARY SLITTING LINES
PIPE AND TUBE MILLS—Electric Weld

CIRCLE INFORM-A-GRAM KEY NO. 12

★ ★ ★ ★ ★ ★ ★ ★

Talk of the Month

★ ★ ★ ★ ★ ★ ★ ★

MACHINE TOOL REPLACEMENT HELPS BUILD PROFITS

by E. P. Leeds
BROWN & SHARPE MFG. CO.
Providence, Rhode Island

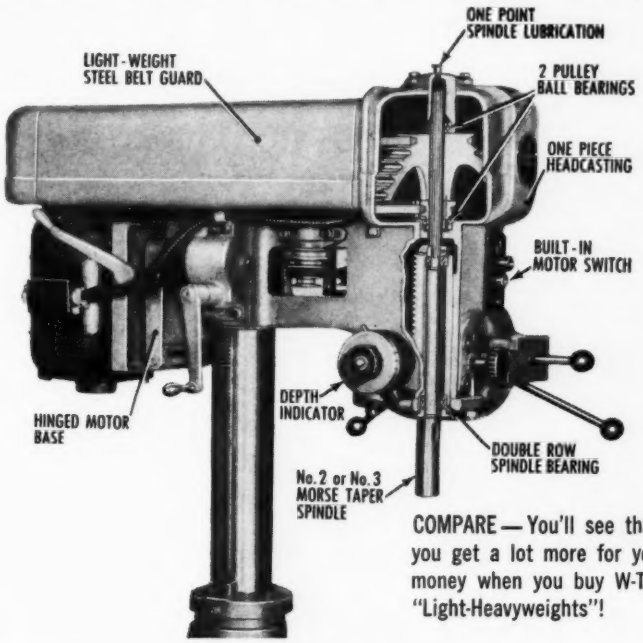
I AM HAPPY TO HAVE BEEN INVITED to speak to you on the subject of machine tool replacement policies. As a part of my company's sales organization I have looked closely at replacement factors in the light of their effect on machine tool sales. Many formalized plans have been carefully studied by our sales organization so that we would be better qualified to discuss this subject with people in the metal cutting industries. Naturally, as you would expect, there is a definite parallel between their use in sales and in promoting greater efficiency in manufacturing divisions.

Just recently we received a letter which read, in part, "We are attempting to develop criteria which may be used in supporting the assignment of standard machine tools to shops and are interested in any formula or methods you may have for this purpose. Specifically, we are interested in what you would consider the most economic basic complement of tools for shops engaged in the support of research and development in terms of lathes, milling machines, grinding machines, etc., per journeyman machinist. Also, we are interested in any criteria you may have developed, such as percent of utilization or actual accumulated operating time, to support the continuing assignment of tools, and what method you use to determine when replacement or retirement is justifiable."

Because it requires a great many considerations in successfully using a formula, such a letter is difficult to answer. Every business needs sound and realistic replacement policies and procedures to assist its management in getting the most out

This address by Mr. Leeds was made before a recent meeting of the National Metal Trades Association.

W-T WALKER-TURNER



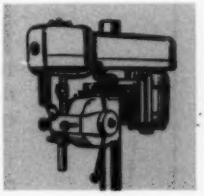
COMPARE — You'll see that you get a lot more for your money when you buy W-T "Light-Heavyweights"!

Here's the inside story of fast, accurate production!

The features you see here add up to unusually fine engineering — the kind you normally find only on heavy, expensive drill presses. But Walker-Turner's 20" press gives you the combination you want — high production rate, at low initial cost.

You can have this W-T 20" Drill Press with hand feed, power feed or the new W-T Air Feed — in bench or floor models; you can set it up in any number of multiple spindles.

1100 Series — Walker-Turner "LIGHT-HEAVYWEIGHT" 20" Drill Press: 6" spindle travel. 10 spline manganese steel spindle. Unusually wide range of speeds — 260 to 2600 rpm, with 1140 rpm motor. Capacity to 1" in cast iron.



Ask your Walker-Turner Distributor to show you what this husky drill press can do for you. He's listed under "Tools" in your phone book's Yellow Pages. Or write for his name and we'll send full descriptions.

DRILL PRESSES, HAND AND POWER FEED — AIR FEED DRILL PRESS ATTACHMENT — RADIAL DRILLS — WOOD AND METAL CUTTING BAND SAWS — TILTING ARBOR SAWS — RADIAL SAWS — JIG SAWS — CUT-OFF SAWS — LATHES — SPINDLE SHAPERS — JOINTERS — BELT AND DISC SURFACERS — FLEXIBLE SHAFT MACHINES

walker-turner

WALKER-TURNER
Division
Rockwell Manufacturing Co. · Pittsburgh 8, Pa.

CIRCLE INFORM-A-GRAM KEY NO. 13

of its capital expenditures. Few companies can afford the luxury of not investigating the possibilities in a good replacement or modernization program. For those who are looking into the subject for the first time the requirements need only be (1) a statement of policy and (2) a reliable technique to analyze modernization programs.

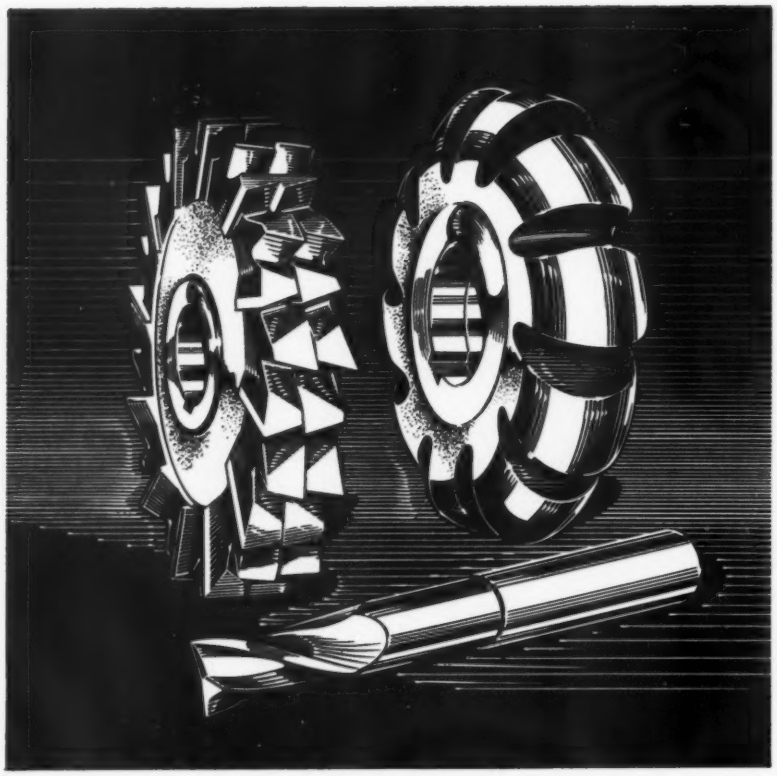
Policy, of course, will vary with different companies depending upon requirements. Nevertheless, every company's policy should include at least a statement of the intent to replace or modernize capital equipment as rapidly as it is economically practical and the statement of intent to review all capital equipment for replacement or modernization at regular intervals. Numerous well managed companies today have established such a plan. Usually this is projected well into the future with a yearly review of the long range projection to make adjustments for changing conditions. The requirements of a good policy not only require a reliable technique for determining when equipment is economically replaceable, but an organizational setup to insure that management is apprised promptly and fully of developing re-equipment opportunities.

After a statement of intent we enter the second phase of establishing a reliable technique to analyze equipment replacement. It is apparent that there is not, to our knowledge, any one formula which can be used by all types of companies. These formulae serve as guideposts and include factors which must be given due consideration. Of course, one of the better known replacement formulas is the one published by the Machinery & Allied Products Institute (MAPI) and is well worth careful study. Their manual is a guide to testing and perfecting replacement practices by bringing up certain vital questions, such as the following:

1. Do you know what equipment in your plant is at present economically replaceable and on what assumptions as to the future it is so?
2. Do you know what it is costing the company on the basis of these assumptions not to make the indicated replacements?
3. Do you have an organizational setup that keeps you currently and continually informed of available replacement opportunities?
4. Does your technique for determining when equipment is economically replaceable meet the following tests?

A. Does it make reasonable and clearly stated projections for the various factors affecting the replacement decision?

B. Does it provide a simple calculation on the basis of these projections?



Are solid high-speed steel milling cutters obsolete?

If they are someone ought to tell our customers about it. They've asked us to produce so many styles and sizes that we finally went all the way and stock the most complete line available anywhere.

No, the solid high-speed steel cutters haven't been obsoleted by the carbides. When it comes to the smaller production runs and toolroom use, the solid steel cutters are *it*. Here, they'll perform more than adequately at the lowest possible initial tool cost. And they're much easier to maintain than the more costly carbide cutters.

Even though Go & Go produces a lot of inserted blade cutters, we're just as proud of our extensive line of solid high-speed steel cutters. Every tool is engineered with the same care and over 38 years of milling cutter know-how goes into each and every one.

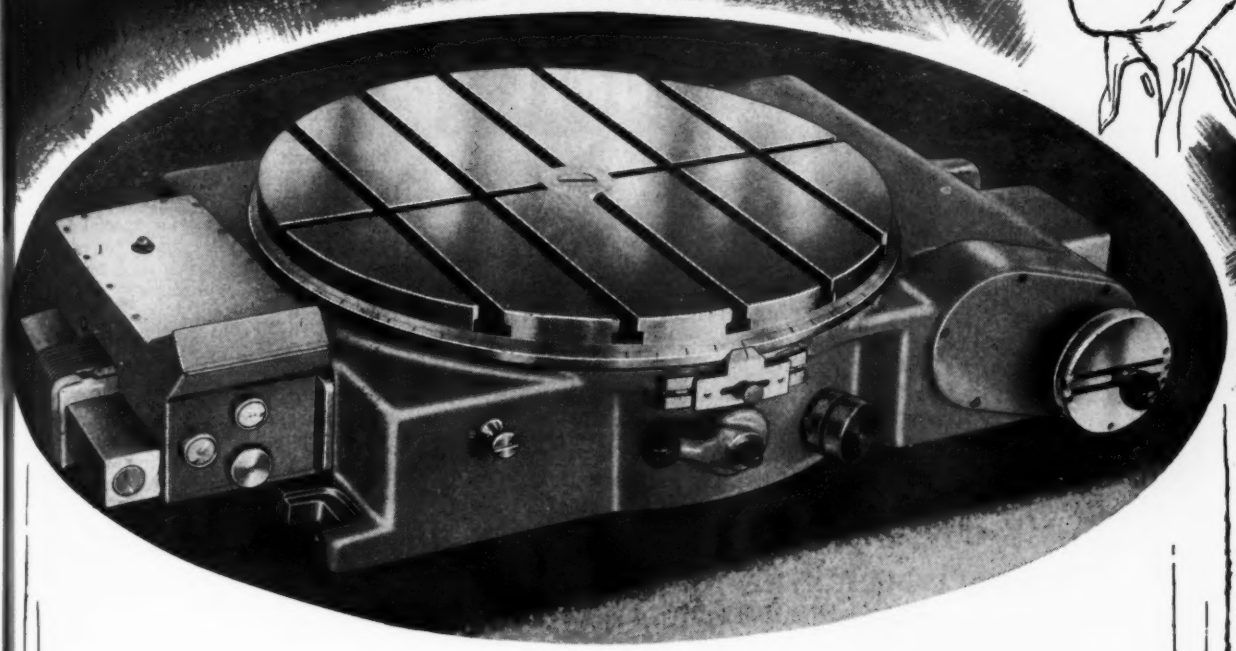
Want to see the extensive stock of standards available? Ask for Catalog F, it's free on request. Go & Go also designs and manufactures special milling cutters in quantity. Check one of our engineering sales representatives in principal industrial centers for details.

Go & Go

GODDARD & GODDARD COMPANY
DETROIT 23, MICHIGAN
Engineering and producing tools that Go & Go since 1917.

CIRCLE INFORM-A-GRAM KEY NO. 14

NO SECOND GUESSING
when you set THIS table . . .



because the new PRATT & WHITNEY 24" *Precision* PLAIN OPTICAL ROTARY TABLE gives direct settings to 1 SECOND OF ARC!

Equipped with an easy-to-read, projection optical system, this 24" Pratt & Whitney Precision Rotary Table provides the MOST CONSISTENTLY ACCURATE MEANS EVER DEVISED FOR PRECISE CIRCULAR SPACING AND ANGULAR POSITIONING. In addition, full 360° adjustment of the optical zero point makes it possible to establish the starting point *anywhere* without disturbing the workpiece. Reversible power rotation insures unequalled speed and ease of operation. Used with Jig Borers or other similar precision machine tools . . . or by itself for inspection or calibrating . . . this one-of-its-kind development will bring new standards of speed, accuracy, efficiency and economy to a wide variety of close tolerance manufacturing operations. For complete information and specifications, write for Circular No. 593. Pratt & Whitney Company, Incorporated, 15 Charter Oak Boulevard, West Hartford 1, Connecticut.

ONE IN A COMPLETE LINE OF P & W PRECISION ROTARY TABLES

PRATT & WHITNEY

FIRST CHOICE FOR ACCURACY

MACHINE TOOLS • GAGES • CUTTING TOOLS

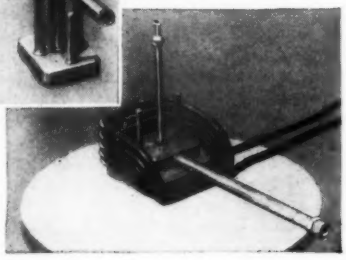
CIRCLE INFORM-A-GRAM KEY NO. 15

The Lepel line of induction heating units represents the most advanced thought in the field of electronics as well as the most practical and efficient source of heat yet developed for industrial heating. With a background of half a century of electrical and metallurgical experience, the name Lepel has become the symbol for quality in induction heating equipment embodying the highest standards of engineering achievement, dependable low cost operation and safety.

If you are interested in the application of induction heating you are invited to send samples of the work with specifications of the operations to be performed. Our engineers will process these samples and return the completed job with full data and recommendations without any cost or obligation.

TYPICAL INDUCTION HEATING APPLICATIONS

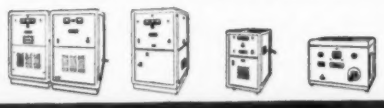
A Lepel installation at Federal Telephone and Radio Co. shown soldering transformer terminals. A precision operation made so simple that even unskilled operators can achieve excellent results on a production basis.



The simultaneous soldering of a group of components within one load coil is an ideal application for induction heating. The assemblies consist of mounting studs and tubes inserted into a machined part together with preformed solder rings. The heating is done so rapidly that there is practically no scaling or discoloration.

Electronic Tube Generators—1 KW; 2½KW; 5 KW; 10 KW; 20 KW; 30 KW; 50 KW; 75 KW; 100 KW.
Spark Gap Converters 2 KW; 4 KW; 7½ KW; 15 KW; 30 KW.

WRITE FOR THE NEW LEPEL CATALOG . . . 36 illustrated pages packed with valuable information.



All Lepel equipment is certified to comply with the requirements of the Federal Communications Commission.

LEPEL HIGH FREQUENCY LABORATORIES, INC.
55th STREET and 37th AVENUE, WOODSIDE 77, NEW YORK CITY, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 16

C. Does it take into account both future deterioration and future obsolescence?

D. Does it take cognizance of both revenue and cost differences?

E. Does it cover mixed expansion-replacement situations as well as straight replacement?

F. Does it yield a measure of the cost of not replacing?

In trying to formulate a reliable replacement technique we at Brown & Sharpe have prepared our own forms which cover requests for expenditures for equipment. This request form is used for new equipment and also for determining whether present equipment should be overhauled. In computing cost, the savings in hours for special purpose equipment are based on average production per year and for general purpose equipment, on the average number of hours used per year. The savings in dollars per year, Items 1 through 6 below, are computed by multiplying the total savings in hours by the hourly rate. Maintenance and installation costs are computed at a fixed hourly rate. The first part of the form is devoted entirely to estimated savings and covers seven points:

1. Saving from the elimination or shortening of other operations in direct labor hours.
2. Saving from reduction in unit hours.
3. Saving in direct labor hours.
4. Saving from reduced spoilage and rework.
5. Saving from reduced special tool cost.
6. Saving from reduced downtime.
7. Saving from reduced maintenance cost.
8. The above 7 items give us total savings per year.

Items 9, 10 and 11 give us a total cost, as follows:

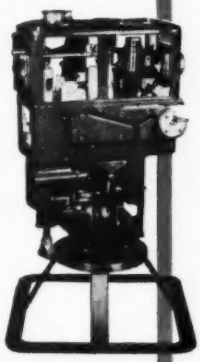
9. Cost of proposed equipment or overhaul.
10. Cost attachments or auxiliary equipment.
11. Cost of installation.
12. Total cost.

The following items:

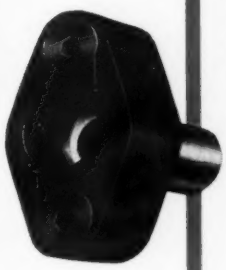
13. Cash available from sale of equipment to be removed,
14. NET COST of Equipment or Overhaul (Item 12 minus Item 13).
15. Number of years required to pay cost of equipment or overhaul (Item 14 divided by Item 8) and
16. Approximate delivery dates are factors which we generally use to make our determination. Quite naturally, as you would expect, reasons for the request must be spelled out and space is provided to give a detailed analysis of expected savings on any item number where necessary. Requests are signed usually by department foremen and approved by the division manager and

5 practical ways to "streamline"

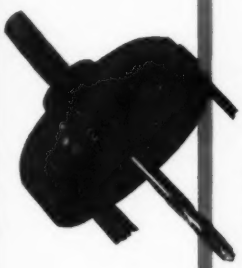
...without sacrificing fastening strength



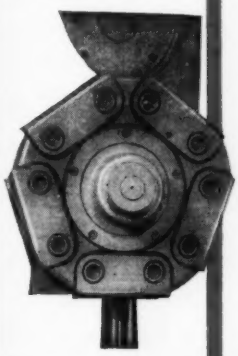
1. Counterbored holes are the simplest approach to flush surfaces using standard socket cap screws. The advantage of specifying genuine Allen O Head Cap Screws is the greater strength of Allenoy steel... you can use smaller sizes for closer spacing and reduced weight. Call on Allen, too, for *very large* socket-head, precision cap screws — up to 2½ inch diameter.



2. Countersinking enables you to get absolutely smooth external surfaces using Allen O Flat Head Cap Screws. Allen O Cap Screws feature the exclusive Leader Point which makes screw starting easier and guards against thread damage.



3. Button Head Cap Screws produce snag-free unbroken surfaces where countersinking is impractical. Button-head hex sockets are necessarily shallow. In genuine Allen O Button-Head Cap Screws, sockets are cold forged without broaching, in extra strength Allenoy steel... essential protection against stripping the sockets under high torque pressure.



4. A ready made hole tapped in forged steel solves many a design problem. It's called the Allenut. It can be anchored in soft material to assure durable threading, or recessed to permit tightening with an Allen Hex Key.

5. Bright finish, or rust and corrosion resistance call for Allen O Stainless Steel Cap Screws. They are standard stocked items (both NF & NC threads) readily available in a wide range of sizes from Allen Distributors.

YOUR ALLEN DISTRIBUTOR can give you practical help and swift service. For complete information on any technical fastening problem, write our engineering department direct.

ALLEN HEAD

ALLEN

MANUFACTURING COMPANY

Hartford 2, Connecticut, U.S.A.

CIRCLE INFORM-A-GRAM KEY NO. 17

Check your template drill bushings against PEM's "score"

* If you don't get the same answers, you may be able to *buy your bushings out of template assembly savings.* Try switching to PEM Self-Clinching Drill Bushings.

QUESTIONS	PEM ANSWERS	
Do your present bushings:	***yes***	***no***
Permit use of thin gauge template metal? (One-third conventional thickness)	✓	
Offer one-hole fastening in template?	✓	
Require processing multiple holes for each bushing?		✓
Are they self-clinching compression mounted?	✓	
Do they require riveting or welding?		✓
Are they round?	✓	
Do they require indexing?		✓
Are they irregular shaped?		✓
Do they require nesting?		✓
Can they "cock" during installation?		✓
Do they assure true alignment, automatically?	✓	
Do they assure true center distances, automatically?	✓	
Are they simple one-piece units?	✓	
Are they assemblies with fastening straps?		✓
Do they permit location in closest proximity?	✓	
Do they have high torque and pullout resistance?	✓	
Do they require special machinery for assembly?		✓
Is specially skilled labor required?		✓
Are bushings hardened steel?	✓	
Are holes burnished to close tolerances?	✓	

*Write for literature and samples for trial.

PENN ENGINEERING & MANUFACTURING CORP.
DOYLESTOWN, PENNSYLVANIA

PEM

CIRCLE INFORM-A-GRAM KEY NO. 18

vice president in charge of all manufacturing.

It appears that this form is very practical and provides a real measure of replacement possibilities. The success of any formula of this nature in a large measure depends upon the ability and experience of the people who use it. Not only is a lot of technical knowledge needed, but a great deal of an uncommon commodity called common sense.

Perhaps, to oversimplify the situation, this type of problem is little different from that facing a home owner who has to determine when to modernize the interior or exterior of his property. In the case of a manufacturer as well as in that of a home owner, there are usually many more requests than can be filled in any one year. We all know that, generally speaking, money is not available to do everything which perhaps should be done at one time Usually, however, a reliable technique plus the common sense approach is our assurance that the most profitable and worthwhile projects get priority.

This type of reliable technique can be applied to many different types of problems. Machine tools which become worn out and must be replaced in order to maintain daily production, fall into an emergency category. Here the determination is based on obtaining the most efficient and economical piece of equipment currently available even though it may not be of exactly the same type. Quite frequently, it is advantageous to replace equipment in departments where common machine tools are used, such as a lathe department, milling department or gear cutting department, in order to take advantage of new time standards applicable to the entire department.

Another use of this technique is in connection with making replacements on a project-wide basis. This approach seems to offer many apparent advantages in that it makes possible a complete review of a given product. The product can be studied to determine if the design meets customer requirements; whether the design permits the product to be manufactured economically; it permits a review in the light of work simplification. It gives us an opportunity to re-time each operation performed on the product to coincide with improved methods and the use of the new equipment.

Because of the magnitude of the product approach it transfers from the lower echelon and junior executive management group the responsibility for many decisions to top management, including the board of directors. It creates new enthusiasm for the overall success of a new installation. It provides an oppor-

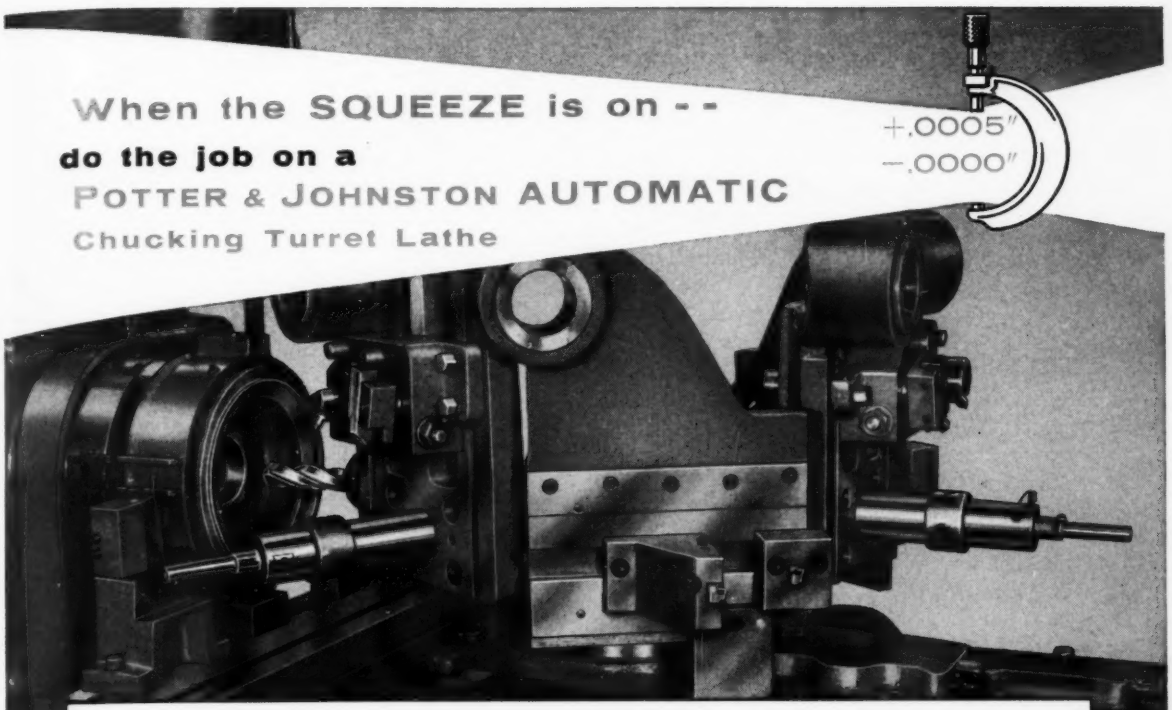
When the SQUEEZE is on - -

do the job on a

POTTER & JOHNSTON AUTOMATIC

Chucking Turret Lathe

+.0005"
−.0000"



a job like this, for example . . .

BEARING BRACKET

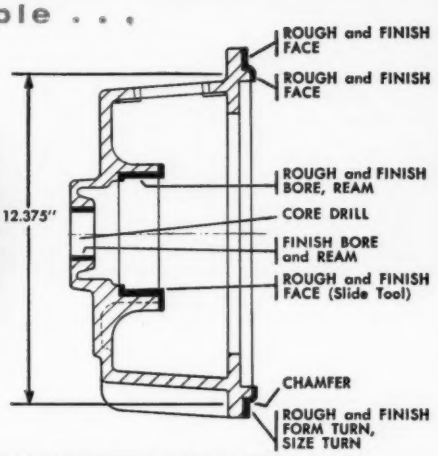
CAST IRON

involving . . .

15 separate close-tolerance cuts including one diameter held to

HALF A THOUSANDTH !

was finish machined - -



in just 4.31 minutes on a

P&J 5-DELX AUTOMATIX with P&J-ENGINEERED TOOLING

More and more jobs are calling for really close tolerances and fine finishes *plus* far faster production rates. Yes – today's higher standards mean the squeeze is on most of the time; these days you're expected to handle, as routine, jobs that were considered "specials" only a couple of years ago. There's just one way to beat the squeeze . . . profitably! Re-equip with Potter & Johnston Automatics that have the extra speed, power rigidity and versatility it takes to produce faster, more accurately and more economically. And team the machine with P&J-Engineered Tooling that takes full advantage of combined cuts and faster-biting carbide tools to reduce machining time to a minimum.

Write for literature or phone the Pratt & Whitney Office near you, and ask a Direct-Factory Representative to call and discuss your requirements. Potter & Johnston Company, Pawtucket, Rhode Island (Subsidiary of Pratt & Whitney Company, Inc.)

P&J

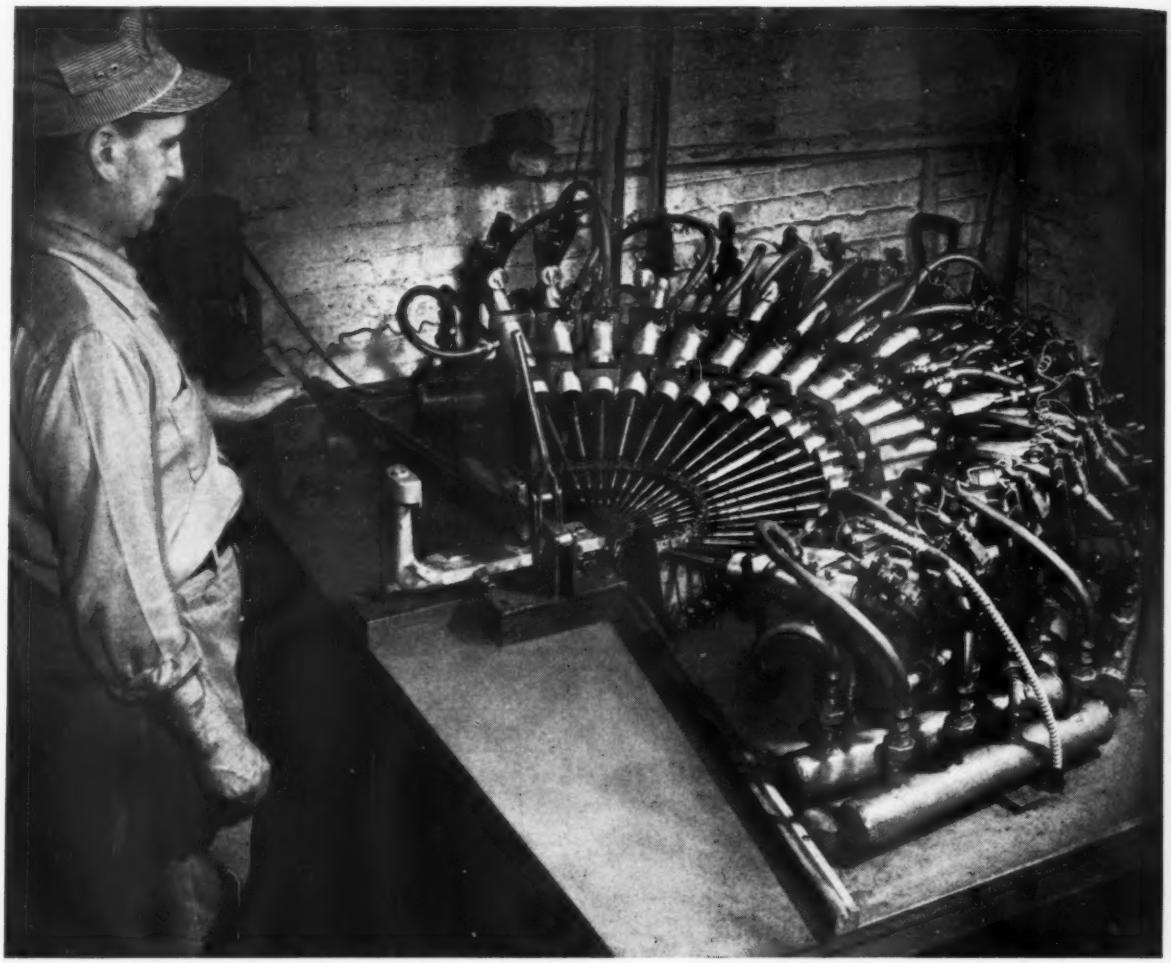
POTTER & JOHNSTON

Precision Production Tooling for More Than Fifty Years

AUTOMATIC CHUCKING TURRET LATHES

CIRCLE INFORM-A-GRAM KEY NO. 19

Gardner Denver . . . Serving the World's Basic Industries



Showing how the Airfeedrills are held in the fixture and how the burner casting is mounted in the jig. Manifolds, which assure proper air volume, are mounted on the bench around outside of tool fixture.

Press a button . . . 20 drilled holes! Use Keller Tool time-saver Airfeedrills

Hole drilling on this gas burner was a time-killer before Keller Tool Airfeedrills® took over. The job was formerly hand-indexed for each of the 20 holes. The drill press spindle was hand-fed for each hole.

Operator now presses the button on a 4-way air valve. Presto, 20 drilled holes in a 40-second cycle—automatically. The drills start simultaneously, advance, drill the holes, retract and shut off—automatically.

Keller engineering ingenuity + Keller air tools = production cost reductions. How about investigating?

GARDNER - DENVER

KELLER TOOL division, Grand Haven, Michigan

THE QUALITY LEADER IN COMPRESSORS, PUMPS, ROCK DRILLS AND AIR TOOLS FOR CONSTRUCTION, MINING, PETROLEUM AND GENERAL INDUSTRY

CIRCLE INFORM-A-GRAM KEY NO. 20

tunity to carefully examine work flow as this particular factor, if handled improperly, can result in substantial losses. Individual or unit replacement can often disorganize a whole line of non-replaced units. This is eliminated. There must always be a yardstick which can be used to find out whether it is economical to proceed with a project involving a particular product. Perhaps a general measure would be a return of 30% yearly on invested capital or a 20% return on the basis of the sales dollars receivable on the product.

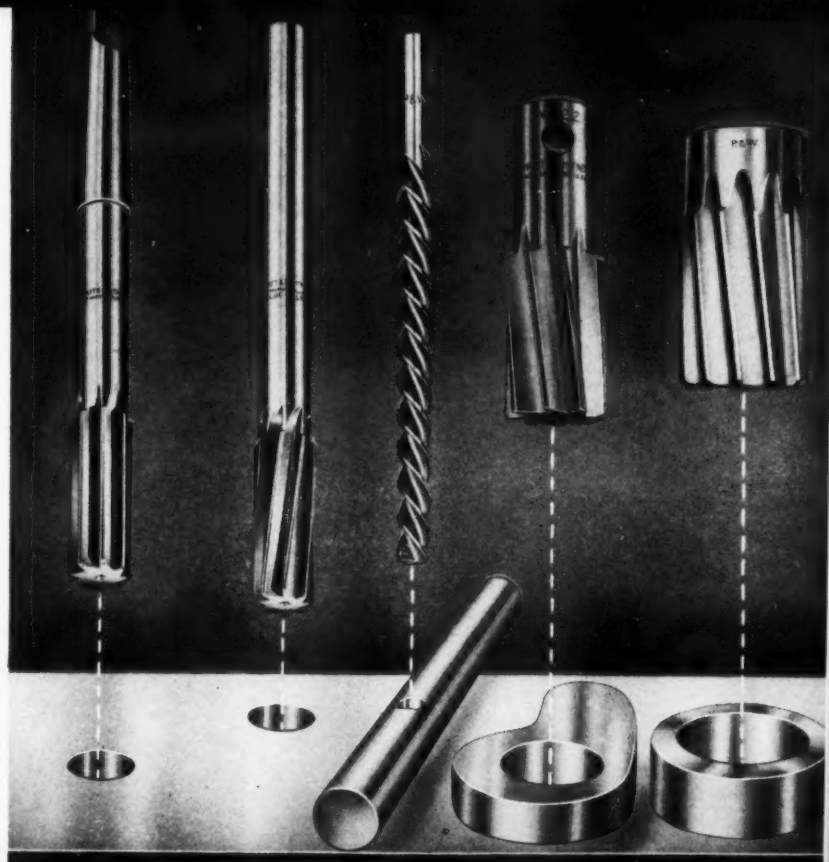
In short, this approach usually provides answers to the following questions:

1. Is this still the most economical process?
2. Are the machining processes still the best available?
3. Is machining necessary on all surfaces presently machined?
4. Can machining operations be combined?
5. Have production quantities changed?
6. Does replacement of one machine affect others?
7. What about operator skill and availability?
8. What of department or plant layout?

There is some danger that replacement at first blush would appear to be a simple matter involving a direct comparison of one tool with another. In practice, it is much more complex and should be handled by specialists. We have recently used this product approach in the manufacture of a new design number 00 automatic screw machine. Because of the magnitude of the project it was divided into several stages. We hope that the benefits previously mentioned will be attained by us. This project has involved many types of machines and for the first time, we believe, in our particular industry, we have installed some machine tools which do individual operations only. An example of this is a machine which drills and taps 34 holes simultaneously in 12 minutes floor-to-floor time as compared to approximately two hours if done on standard machines. Our analysis shows that even though the machine may not operate all the time, production is such that this idle time can be discounted.

Finally, we hope that we will substantially reduce our manufacturing or in-process time to gain manufacturing flexibility to meet sales requirements, substantial reduction in unit time of machining operations, a simplification of machine operations to reduce the experience factor required of operators, a further improvement in quality of our work and the consequent reduction in spoilage or rework; an improvement

. . . *Continued on Page 36*



PRATT & WHITNEY
Quality REAMERS

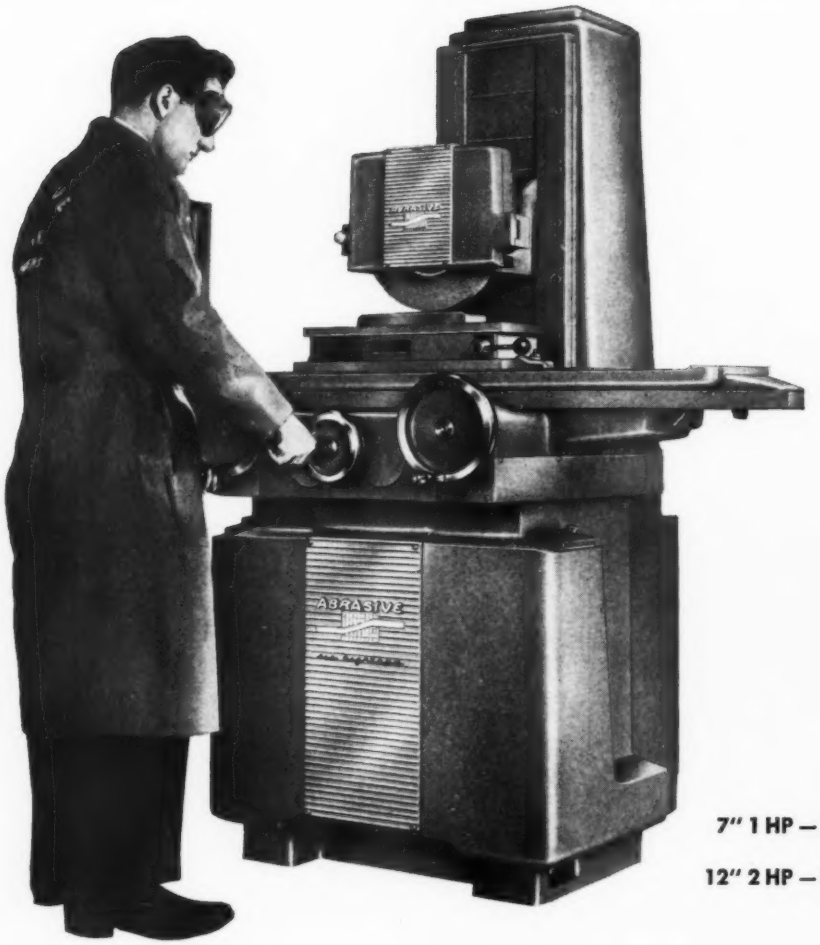
for the long run . . .
because they run longer!

When you buy reamers, you're *really* buying the number of smooth, round, accurate holes each tool will produce. That's why Pratt & Whitney Reamers — cutting smoother, faster and longer — are your best buy in the long run. From the start (with selected steels and proved-correct design) . . . to the finish (the distinctive P&W special surface treatment) . . . they're quality *all the way!*

Pratt & Whitney manufactures complete lines of reamers for every industrial application . . . and you can select standard types and sizes from on-the-shelf stocks at Pratt & Whitney Branches. Hardened blanks are carried in stock for quick delivery on non-standard sizes.

FOR COMPLETE INFORMATION . . . write for free product literature stating the reamer types you're interested in.

PRATT & WHITNEY COMPANY
INCORPORATED
:5 Charter Oak Boulevard, West Hartford 1, Connecticut
Branch Offices and Stocks in Principal Cities
MACHINE TOOLS • GAGES • CUTTING TOOLS



7" 1 HP — $1950.00

12" 2 HP — $1985.00

.....the entirely NEW ABRASIVE six eighteen

hand feed precision surface grinder!

You're gonna be nuts about this entirely new Abrasive Surface Grinder. Everyone else in your company will, too! The new Abrasive Six Eighteen combines new size (6" x 18") and modern design with new Abrasive-engineered operational features.

Our new illustrated catalog tells all . . . all about Abrasive's effortless anti-friction roller ways; totally enclosed motorized spindle; new, chatterless cable table drive (successfully tested for over 1,000,000 quick reversals); convenient, waist high table and elevating hand wheels; deep, heavily-ribbed saddle; optional 12" or 7" wheel head; and how you can have the elevating and table hand wheels on either right or left.

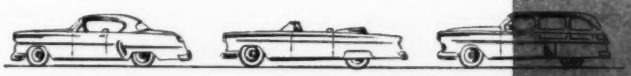
Yours Free!

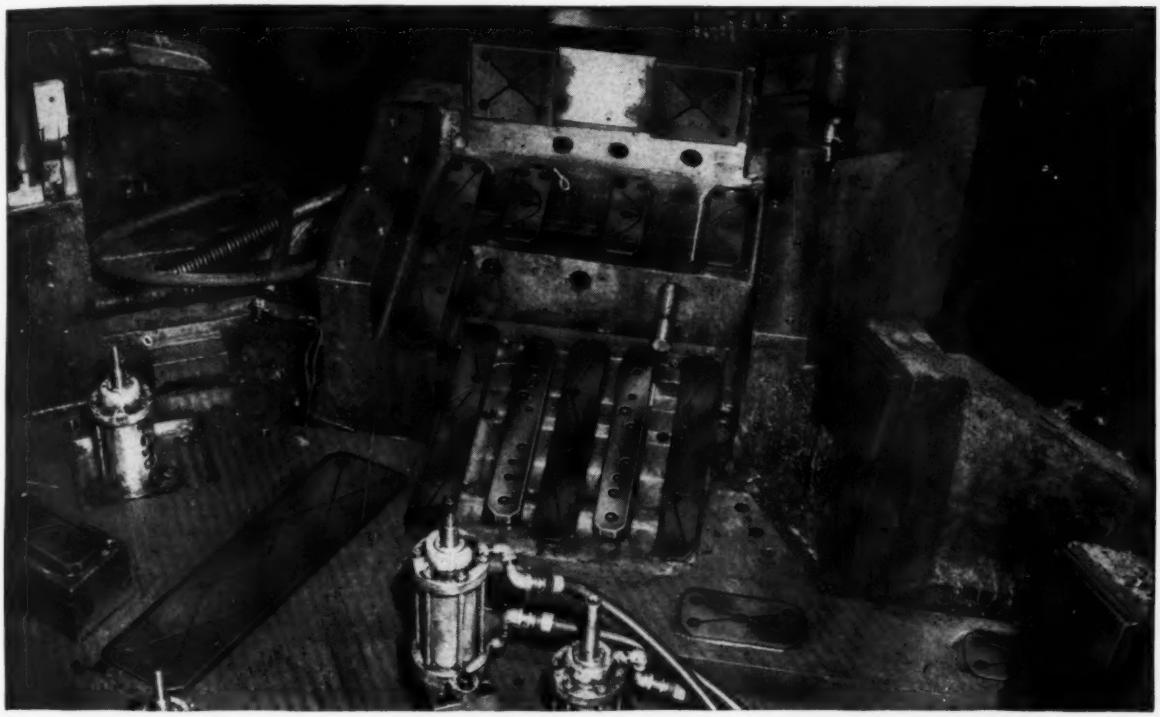
ABRASIVE
Machine Tool Company
East Providence 14, Rhode Island

ABRASIVE ACCURACY BOOSTS PRODUCTION

CIRCLE INFORM-A-GRAM KEY NO. 22

IT'S OK WHEN YOU FOLLOW THE LEADERS





The automotive industry stands as a leader in technological advancement and cost-cutting production techniques. That's why today practically every important automobile manufacturer is using Ohio Knife Aluminum Bronze Wear Plates on body dies.

By a unique clading process, long-wearing aluminum bronze is bonded to a machinable steel base. Cost is drastically lower when compared to solid cast bronze plates. A finer quality bearing surface is obtained, resulting in longer life. When fitting is required to suit die, steel backing of plate is easily machinable, and no difficulty is encountered drilling or counter boring through bronze surface. OK aluminum bronze plates are applicable wherever a die has a sliding or cam action. A large selection of OK aluminum bronze plates carried in stock . . . finished ground, flat and parallel . . . ready to ship. Specials made to your specifications.

Manufacturers for the metalworking industry of: SLITTER KNIVES • SHEAR BLADES BRONZE WAYS • WORK-REST BLADES • CUT-OFF BLADES • SCRAP CHOPPERS HARDENED SPACERS • BALL RACES • HARDENED WAYS • WEAR STRIPS • GIBS

For free bulletin "SLITTING—A Basic Guide for the New Operator", write Dept. 29-LL

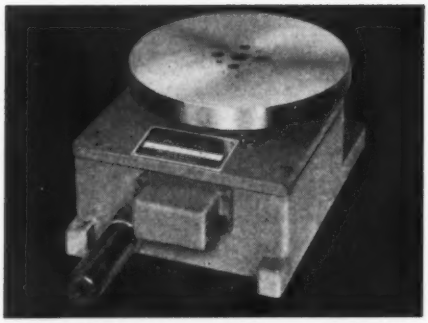
THE OHIO KNIFE CO.

CINCINNATI 23, OHIO

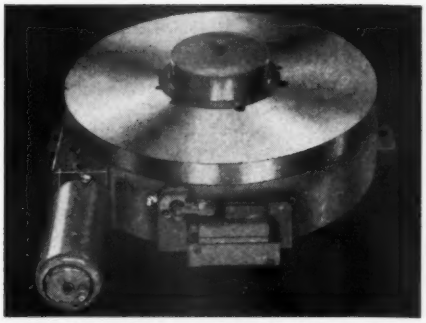
CIRCLE INFORM-A-GRAM KEY NO. 23

QUALITY **PDC** SERVICE

"AUTOMATIC" Pneumatic Assembly Equipment Components

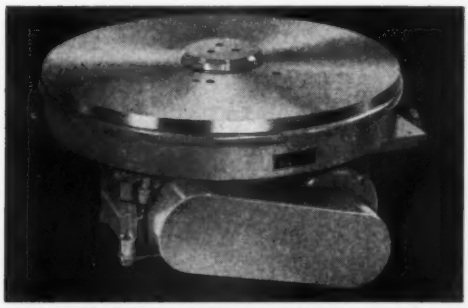


PDC-AM 10 Geneva Motion Index Table (Complete with Controls)



PDC-AM 14 Geneva Motion Index Table (Complete with Controls)

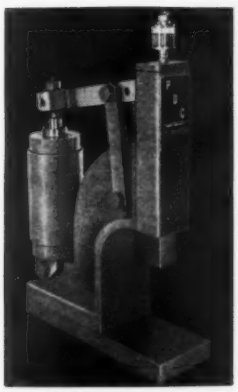
PDC-14 Geneva Motion Index Table



PDC-EMD 26 and **PDC-AM 26** Geneva Motion Index Table

PDC AT 6 Presshead

PDC "AUTOMATIC" Dial Assembly Press (Range to 6 Tons)



PDC AL 1 Presshead

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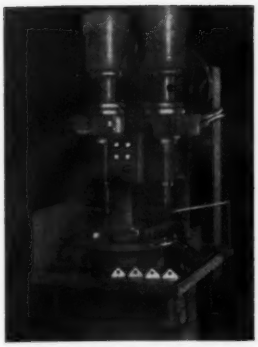
CIRCLE INFORM-A-GRAM KEY NO. 24

QUALITY **PDC** SERVICE

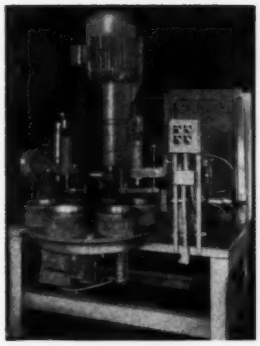
"AUTOMATIC" Special Machines

using PDC "*Automatic*" Assembly Equipment Components



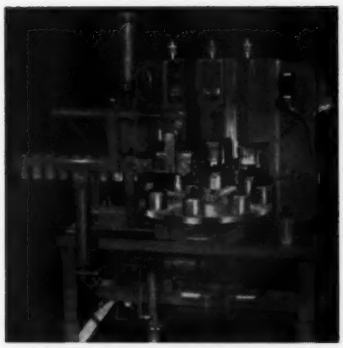
"Automatic" Two Spindle, Lead Screw tapping Machine with PDC-AM 14 Index Table

12016-1



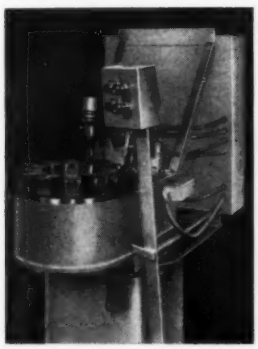
"Automatic" Drilling and Bead Spinning Machine with PDC-EMD 26 Index Table and PDC-AL 225 Spinning Head

12402-2



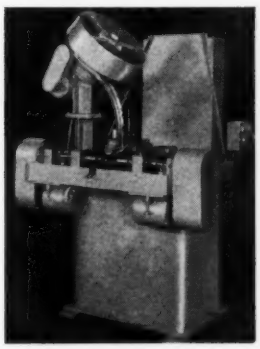
"Automatic" Coil Can Closing Machine with PDC-14 Index Table, three PDC-AT 4 Press Heads and Automatic Ejector

12428-3



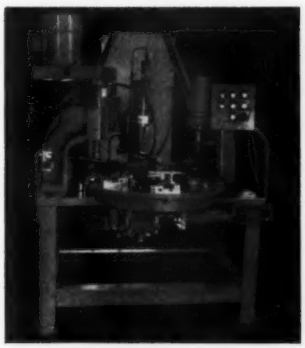
PDC-14 "Automatic" Index Table with High Speed Riveting Hammer

12030-3



"Automatic" Hopper-Fed Double End Chamfering Machine

12030-5



"Automatic" Reaming, Hopper Feeding, and Inserting of Bushing and Burnishing Machine

12069-2

When you have similar production operations to perform, send in your sample parts or prints for immediate quotation on special production machines to suit your specific requirements. . . .When sending for literature or information, please refer to picture number.

PRECISION DETROIT CO.

Specialists in Hopper Feeding and the Combining of Operations around Index Tables

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CIRCLE INFORM-A-GRAM KEY NO. 25

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Available for all sizes of above machines up to and including 3½" capacity.

Style "S"
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Pads Cannot Work Loose
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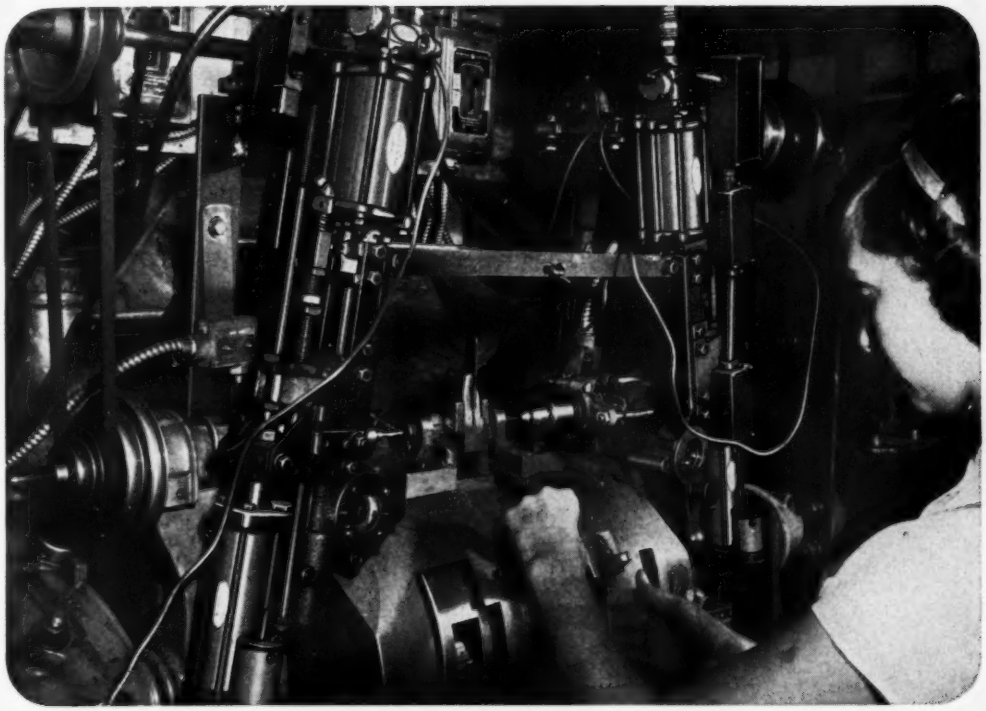
CIRCLE INFORM-A-GRAM KEY NO. 26

661B-1



This special machine built in the plant of Safe Padlock & Hardware Co., drills and taps turnbuckles. It uses two Bellows Drill Press Feeds and a Bellows Rotary Feed Table. It cuts production cost 75%.

How to reduce the cost of SPECIAL MACHINES

Special machines are often the only answer to lower cost production. But for short or medium runs, special machines often just aren't practical unless they are sufficiently flexible to be readily adaptable to different jobs.

You can solve that problem of special machines by building them in your own tool room with Bellows "Controlled-Air-Power" work units. You can build them in a fraction of the time, at a fraction of the cost of expensive custom-built machines. Best of all, when the special machine has served its purpose, the basic Bellows work units can be easily redesigned into other pieces of equipment.

Bellows Field Engineers (125 of them—one or more in every major industrial area in the United States and Canada) will be glad to work with your production people in applying Bellows "Controlled-Air-Power" to your specific needs.

Have you seen OPERATION PUSHBUTTON?

This half hour Bellows motion picture shows how all lines of industry use "Controlled-Air-Power" to lower costs. To arrange a showing, merely write on your letterhead. No cost. No obligation.

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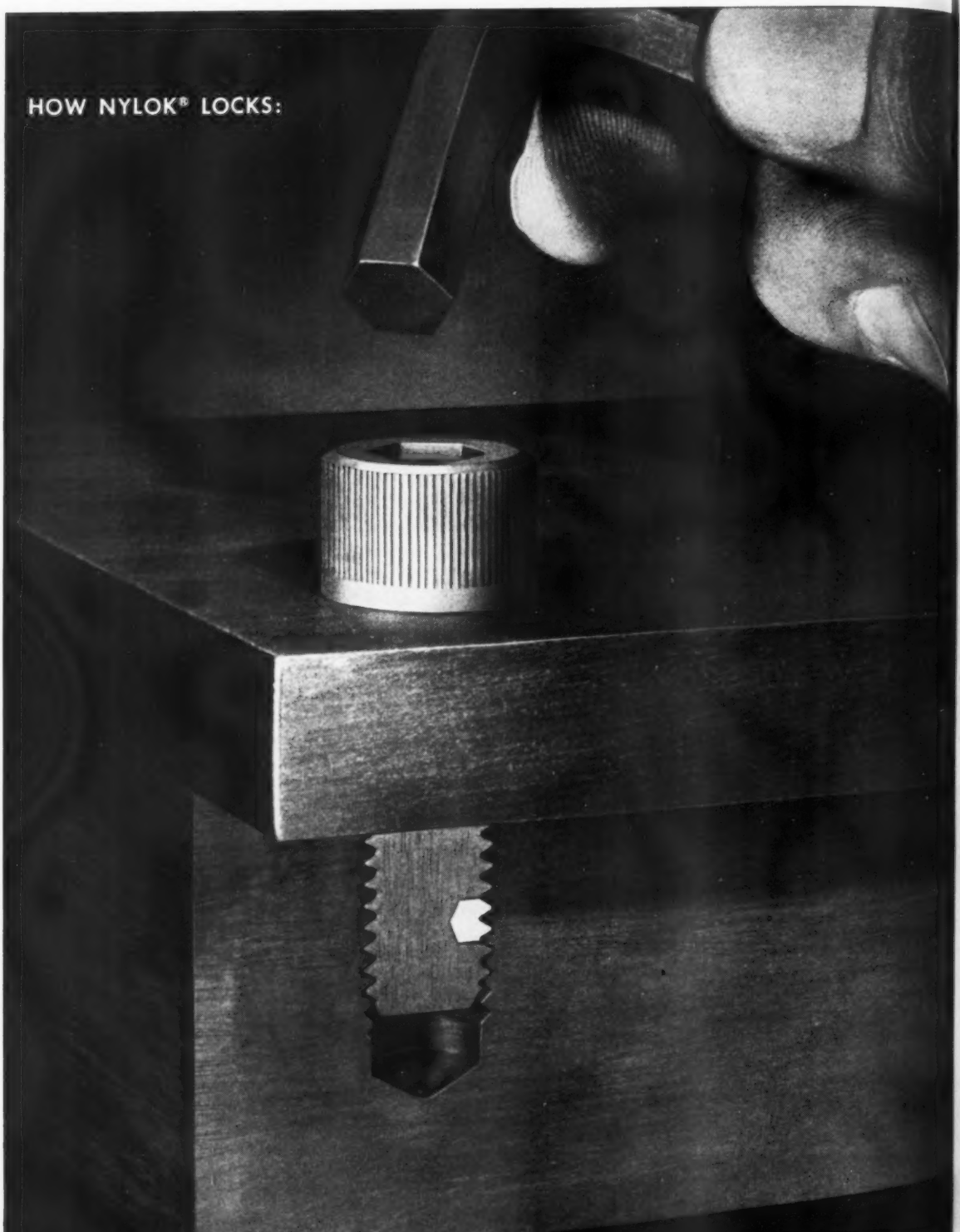
The Bellows Co.
AKRON 9, OHIO

4618-1

CIRCLE INFORM-A-GRAM KEY NO. 27

NEW—self-locking UNBRAKO so



LOCKED! The tough, resilient nylon pellet keys itself into the mating threads. It forces threads together and locks the screw securely.

Self-lockin

BEFORE
jects slight
be impres

AFTER
pellet has
greater di
can be us
keeps thre

socket head cap screws

Self-locking UNBRAKO socket head cap screw.

BEFORE ASSEMBLY. The nylon pellet projects slightly. When assembled, threads will be impressed into it.

AFTER REMOVAL. "Plastic memory" of pellet has expanded impressed threads to greater diameter than screw threads. Screw can be used repeatedly. In use, "memory" keeps threads tightly locked.

They won't work loose. And they simplify design and save production time.

UNBRAKO socket head cap screws are now available embodying the Nylok* self-locking principle. Nylok provides the first truly practical solution to the problem of making cap screws self-locking.

An UNBRAKO cap screw with Nylok is a single self-locking unit. No auxiliary locking devices are needed. Just thread the UNBRAKO into any tapped hole. *Seated or not*, it locks positively wherever wrenching stops. The tough, resilient nylon pellet forces mating threads together and holds tight. The screw will not work loose.

You save production time when you make products with self-locking UNBRAKOs. And you get greater simplicity in design with less bulk and weight. The number of parts you must assemble to achieve full locking action is reduced to the absolute minimum. Lockwashers under screw heads are no longer necessary. Costly wiring of cross drilled heads is eliminated. And in many cases you will save weight and mass by using shorter screws in tapped holes instead of drilling through and using nuts and lockwashers.

Self-locking UNBRAKOs are reusable. They have uniform locking and installation torques—with no galling or seizing on mating threads. They successfully withstand temperatures from —70° to 250°F. And, when screws are properly seated, the locking pellet also functions as a liquid seal.

A complete line of self-locking UNBRAKO socket screw products, in a wide range of standard sizes, materials and finishes, is available through your authorized industrial distributor. Technical data and specifications are detailed in Bulletin 2193. Write us for your copy today. Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 62, Pa.

**T.M. Reg. U.S. Pat. Off., The Nylok Corporation*

UNBRAKO SOCKET SCREW DIVISION

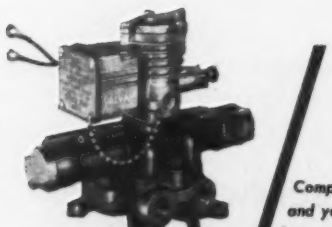
STANDARD PRESSED STEEL CO.

SPS

JENKINTOWN PENNSYLVANIA

CIRCLE INFORM-A-GRAM KEY NO. 29

VALVAIR
is everywhere



Compare... and you'll buy

Valvair

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Valves — by Valvair — are everywhere . . . on the best production and automated equipment . . . in mills, factories, foundries and assembly plants.

That's because they deliver *performance*. Users report Speed Kings are still working satisfactorily after 25 million cycles. And they're *guaranteed against coil burnout* for the life of the valve. What's more, with Valvair valves you pay for only the features you want for your specific application.

And equally important, Valvair has sales-service representation in all major industrial areas. So bring your valve problems to Valvair *first*—for Valvair is everywhere. A call will bring our representative on the double. Valvair Corporation, 454 Morgan Avenue, Akron 11, Ohio.

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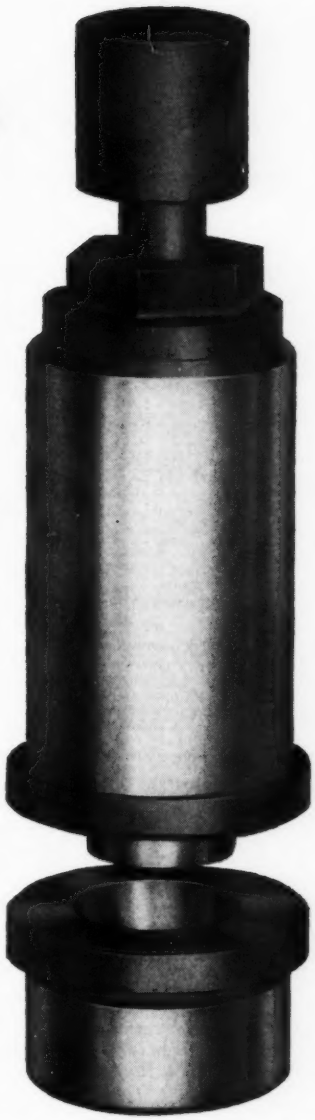
Representation in: Baltimore • Birmingham • Boston • Buffalo • Charleston, W. Va. • Chicago Cleveland • Cranford, N. J. • Dayton • Denver • Detroit • Eureka, Calif. • Grand Rapids Houston • Indianapolis • Kansas City, Mo. • Logansport, Ind. • Los Angeles • Louisville • Miami Milwaukee • Minneapolis • Muncie • New Orleans • New York • S. Pasadena • Philadelphia Pittsburgh • Portland, Ore. • St. Louis • Seattle • San Francisco • Syracuse • Montreal Toronto • Vancouver

CIRCLE INFORM-A-GRAM KEY NO. 30

STANDARDIZED UNIVERSAL INDEX PLUNGERS

SAVE TIME SAVE MONEY

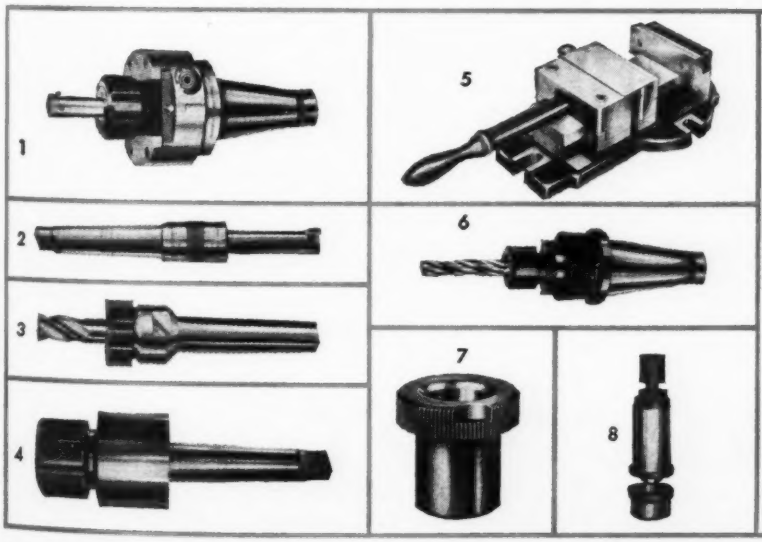
Universal's Straight and Taper Plungers made in standard sizes save the time and expense of designing and machining special index plungers for multi-station tools. They come to you complete, ready for installation at approximately ¼ the cost of specially made plungers.



Soft pin knob permits connection to actuating lever or air cylinders by several different methods. Locating bushing, plunger and plunger bushing are hardened and ground.

Plunger is easily assembled from either top or bottom. And it can be removed in either direction by removal of hex nut.

Universal Plungers greatly simplify jig or fixture manufacture because plunger body and bushing have same diameter so that all holes can be bored with same tool, often in same setting.



UNIVERSAL ENGINEERING COMPANY

FRANKENMUTH 8

MICHIGAN

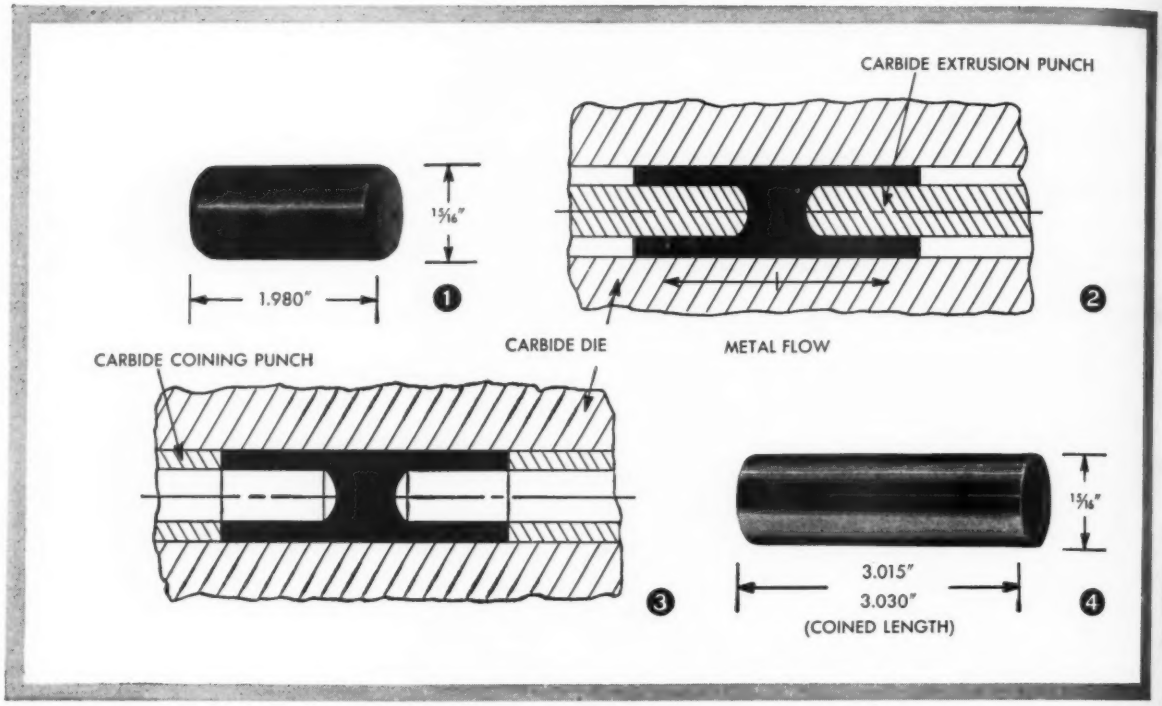
(1) BORING CHUCK
(2) MIKRO-LOK BORING BAR
(3) STANDARD COLLET CHUCK
(4) FLOATING COLLET CHUCK
(5) WEDGE-LOCK PRODUCTION VISE
(6) "KWIK-SWITCH" TOOL HOLDER
(7) STANDARD DRILL BUSHING
(8) UNIVERSAL INDEX PLUNGER

168

CIRCLE INFORM-A-GRAM KEY NO. 31

Increased output, material savings, and improved strength are accomplished . . .

Ford Motor Company cold-extrudes steel wrist pins with Carboloy dies



Solid steel slug (1) is cold extruded by opposed carbide punches (2) into correct shape. Carbide coining punches (3) size the pin to correct length, holding 0.015" tolerances. Finished pin (4) has the same volume of metal as the original slug. Only metal loss is in finish-grinding operation.

Almost 2000 two-inch steel slugs are cold extruded into three-inch wrist pins every hour at Ford Motor Company's new Cleveland engine plant.

The eight-station die holding the work, and the punches that extrude and coin the pin, are made of Carboloy* cemented carbide. By cold extruding with carbide dies, Ford has gained these important cost and product advantages: stronger, better parts, made from a low carbon, low alloy steel, with no scrap loss from machining . . . produced far faster than possible by machining.

Cold extrusion with carbide dies and punches can bring these and other benefits to many metalworking companies. Carbide engineers, with years of experience on cold-extrusion problems, are available to help work out specific applications.

To find out if cold extrusion with Carboloy cemented carbide dies is feasible for your application, check with your diemaker, or send your specifications to: *Metallurgical Products Department of General Electric Company, 11111 E. 8 Mile Road, Detroit 32, Michigan.*

CARBOLOY®

CEMENTED CARBIDES

*"CARBOLOY" IS A TRADEMARK OF GENERAL ELECTRIC COMPANY

CIRCLE INFORM-A-GRAM KEY NO. 32

over 8,000 Different Cylinder SELECTIONS—

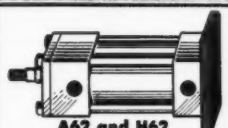
Miller AIR AND HYDRAULIC CYLINDERS AND BOOSTERS "IN STOCK" for immediate delivery.

See Miller Bulletins A-105K (Air) and H-104K (Hydraulic) for Complete Dimensions and Engineering Data on these "in-stock" sizes and other Custom Miller Cylinders in bores up to 20" and strokes up to 22 feet.

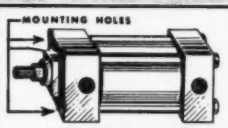
"IN-STOCK" MODELS

"A" Signifies Miller 200 psi Air Cylinders; "H", 2000 psi Hydraulic Cylinders. Interchangeable Mountings Are Shown In Rod On Drawings.

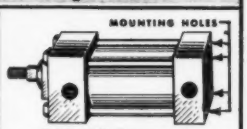
A61 and H61
Flange Mounting on Rod End
(A61 not available in 8" bore)



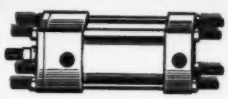
A62 and H62
Flange Mounting on Cap End
(A62 not available in 8" bore)



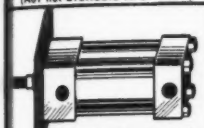
A63—8" Bore only
Flange Mounting on Rod End



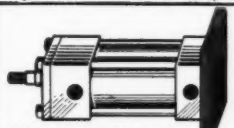
A64—8" Bore only
Flange Mounting on Cap End



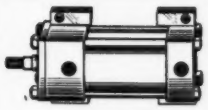
A50 & H50—Tie Rods not extended beyond nuts.
A51 & H51—Tie Rods extended both ends (shown).
A52 & H52—Tie Rods extended. Cap End only.
A53 & H53—Tie Rods Extended. Rod End only.
A54 & H54—Two Tie Rods extended at both ends.



H65—Hydraulic Only
Flange Mounting on Rod End

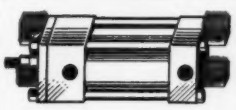


H66—Hydraulic Only
Flange Mounting on Cap End

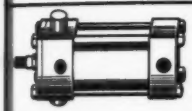


A72 and H72
Side Lug Mounting

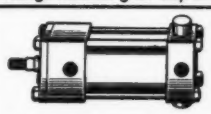
A74 and H74
Side Flush Mounting



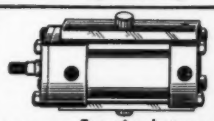
A77 and H77
Side or Foot Mounting



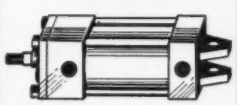
A81 and H81 Trunnion Mounting on Rod End



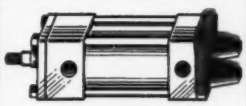
A82 and H82 Trunnion Mounting on Cap End



A83 and H83 Trunnion between Head and Cap
(one week delivery)



A84 and H84
Pivot Mounting



A86 and H86
Pivot Mounting

"IN-STOCK" STROKES (in Inches)

IN-STOCK BORES		BORES	ROD DIA.	ROD TURN DOWN & THREADS																				
AIR		1½	⅝"	7/16-20	Cushioned			3	4	5	6	7	8	9	10	11	12								
					Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12								
		2	⅝"	7/16-20	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
					Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
		2½	⅝"	7/16-20	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
					Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
		3¼	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
					Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
		4	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
					Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
		5	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
					Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
		6	1⅜"	1-14	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
					Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
		8	1⅜"	1-14	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
					Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
HYDRAULIC		1½	⅝"	7/16-20	Cushioned			3	4	5	6	7	8	9	10	11	12									
					Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12									
		2	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
					Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
		2½	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
					Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
		3¼	1⅜"	1-14	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
					Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
		4	1¾"	1¼-12	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
					Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
		5	2"	1½-12	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
					Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36

① "A" and "H" Models 82, 84 and 86 with strokes over 18" require stop tubes.

Column strength requires larger diameter piston rods for the following:

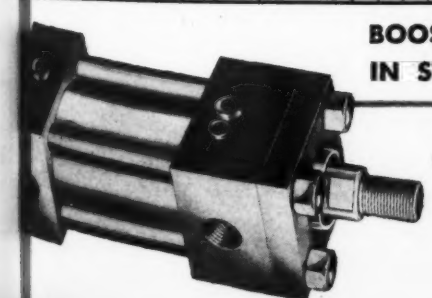
Air Cylinder Models A82, 84, and 86 with strokes inside area (1), when operated at 100 psi and over;

All hydraulic models with strokes inside area (2) and Models H82, 84, and 86 with strokes in area (4), when operated at 2000 psi and over;

Models H82, 84 and 86 with strokes inside area (3), when operated at 1000 psi and over.

Depending upon Trunnion Pin location, "A" and "H" Models 83 with standard diameter piston rods can have longer strokes than Models 82, 84 and 86.

See Miller File #251 for oversize piston rod and stop tube requirements.



BOOSTERS IN STOCK

Immediate Delivery on the following Miller 25 to 1 Ratio Boosters (80 psi air input produces 2000 psi hydraulic oil output): Model B4, 5" bore, 1" dia. ram, 6" and 12" strokes; Reciprocating Booster Model DA77-RBA8, 5" bore, 1" dia. ram, 6" stroke. Also Booster Tanks, 5" dia., 6" and 10" heights.

Write For Catalog and Stock Price List

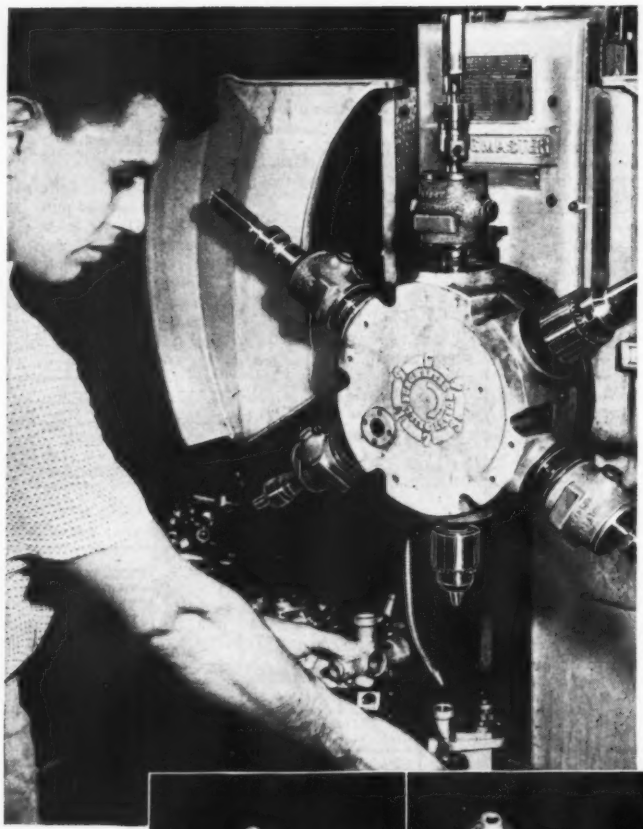
Miller

MILLER FLUID POWER DIVISION
FLICK-REEDY CORP.

2046 N. Hawthorne Ave., Melrose Park, Ill.

AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS

BURGMASTER® 6-Spindle Turret Drill increases production 200% at J. & S. Carburetor Co., Dallas



Here is a "before and after" story which indicates Burgmaster's great ability to increase production, save time, reduce operator fatigue, and improve accuracy and quality of work.

This experience is one of many. If you have a job requiring multiple operations (drilling, reaming, tapping, counter-boring, etc.), this can be accomplished in one setup, with one operator, automatically with a Burgmaster.

This part, shown in production plant photo, is die cast zinc 600 regulator body. Four tapping, one core drilling operations are performed in one setup, using indexing fixture. Production, 32 parts per hour. Rejections, less than ½ of 1%. No comparative data available as machine was purchased for this operation.

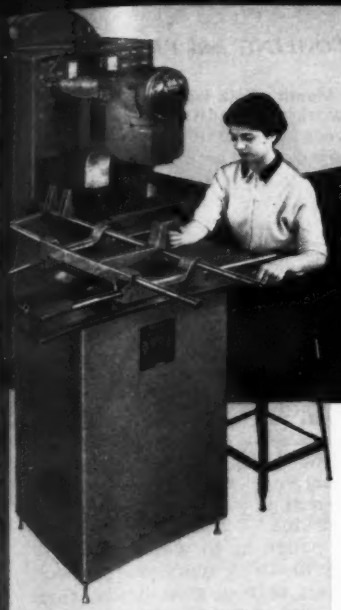
Vaporizer head (B1112 mild steel) work performed on the circumference and consists of center drill, 2-step drill, drill and chamfer, drill and tap. Work done in one setup on indexing fixture. Production, 17 per hour. Tolerances, .001″ in size, .005″ in depth. Production increased 200%. Rejections decrease from 4% to less than ½ of 1%. Six drill press, two turret lathe operations were eliminated.

For complete information, write Dept. TP 11.

BURG TOOL
Manufacturing Company, Inc.
15001 South Figueroa Street, Gardena, California

Sales Offices: **RIDGEWOOD, N. J.**—Burgmaster Eastern Sales Div., 86 N. Maple Ave., Phone: Gilbert 4-3002. | **CHICAGO**—Burgmaster Machinery Co., 5329 Lincoln Ave., Phone: UPtown 8-7161. | **SAN FRANCISCO**—Paul A. Kulju, 857 Estabrook St., San Leandro, Calif., Phone: LOckhaven 9-2244

CIRCLE INFORM-A-GRAM KEY NO. 34



HOLE PUNCHING
PRINTED CIRCUITS
the "WALES-WAY"

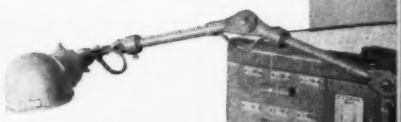
- **FASTER**
- **MORE ACCURATE**
- **CUTS COSTS**
- **PUNCHES COLD**

The Wales Fabricator with positive Duplicator is the modern low cost answer to printed circuit hole punching. For sharp definition, clean walls, minimum bell mouth, the "WALES-WAY" of cold punching is ideal for short runs from one piece to thousands.

Change dies in seconds with a range up to 3½" dia. and with a total absence of cracks or halos around the periphery of the hole regardless of size or cluster.

Pilot pin work holders are positive guarantee of accuracy in every operation and set-up time is thus greatly reduced. Equipment and work may be instantly checked at any time. It is no longer necessary to establish two square sides . . . the pilot pins guarantee exact relationship of pattern to work piece.

20 ton Fabricator capacity permits punching templates from stock up to ¼" thick. Drilling machines, jig borers or other template making equipment is not necessary. The WALES Fabricator - Duplicator combination is a complete shop in itself. All tooling is instantly available.



We have Engineers fully experienced in the production of printed circuits. These men are available to give you a complete survey with findings and recommendations. This service can save you much in time and money and we welcome your inquiry.

WALES Mobile Units will bring the Fabricator with Duplicator for demonstration at your door. Arrangements can be made to show you at an early date. Write us for schedule.

Send for Bulletin No. 11K

A "WALES-WAY" Printed Circuit folder is available and will be sent without obligation.

Showing the WALES FABRICATOR and positive DUPLICATOR with Printed Circuits of various designs.

WALES Strippit COMPANY

"...the Wales-Way is the PLUS-PROFIT way"

345 PAYNE AVE. — North Tonawanda, N.Y.

WALES-STRIPPIT OF CANADA LTD., HAMILTON, ONT.

CIRCLE INFORM-A-GRAM KEY NO. 35

ANGLE TOOLS?

BUCKEYE builds all types!

DRILLS

90° Heavy-Duty

360° Heavy-Duty

90° Close-Coupled

30° Collet

NEW
90° angle head nutrunners, reversible. Standard head illustrated; also available with short coupled head.

30° Chuck

SCREWDRIVERS

90° Chuck

NEW
Short-coupled drills, screwdrivers, nutrunners, designed for working in areas where operating room is extremely limited.

90° Collet

NUTRUNNERS

90° Reversible

There's a Buckeye angle tool for every drilling and fastening job—including yours. No matter how special your requirements, you're sure to find a Buckeye angle tool exactly suited to your work. Choose from almost 500 types, models and speeds—all described in our Catalog A-10.

Buckeye Tools CORPORATION
DIVISION 19 • DAYTON 1, OHIO

producers of the world's first successful rotary air tools

CIRCLE INFORM-A-GRAM KEY NO. 36

. . . Month's Talk from Page 21

in working conditions for our employees, particularly from a safety factor due to better material handling facilities and, last but not least, we have contributed a manufacturing facility capable of high production of a very important machine tool which is a major contribution to our national defense.

The problem of replacement is a real live growing factor in industry today and is worthy of continuing study and review. In summarizing I'll leave you with the following suggestions:

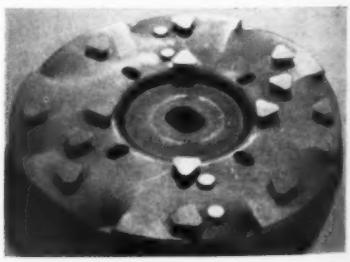
Continue — A long range analysis of your equipment as to its age, productivity, repair cost, etc., as compared to your competitors.

Continue — The determination of your policy as to whether you are going to be a marginal producer, profiting only in good times, or can meet any competitor's prices and produce to customer's specifications at a profit. The equipment you need to be eligible for this latter exclusive class is usually modern equipment. Because it is not wise to buy all new equipment each 5 or 10 years, a healthy vigorous program of replacement of 10% to 20% of your machines each year and every year should be to your advantage.

Stainless Steel Extends Cutter Blade Life

The garbage disposal cutter blade shown here was once made of carbon steel, chrome-plated. Teeth were stamped through the plate before plating, but the plating wore off, teeth broke, and wear and corrosion caused trouble.

Then the manufacturer found he could improve his design, get greatly increased service life, and a 15% to 20% faster cutting rate with 17-7



PH (precipitation-hardening) stainless steel.

The new design has stamped cutting edges with teeth of triangular cold-headed 17-7 PH stainless rivets. The entire plate is heat-treated after fabrication and the heads ground flat after assembly.

MOORE SPECIAL TOOL COMPANY

Holes, Contours, Surfaces

Published in the interests of greater accuracy and quality in the toolroom and on the production line by the Moore Special Tool Co., Inc., 726 Union Ave., Bridgeport 7, Conn., builders of Jig Borers, Jig Grinders, Panto-Crush Wheel Dressers, Precision Rotary Tables, Motorized Centers and a complete line of Hole Location Accessories.

Why you should use the Jig Borer and Jig Grinder to inspect their own work

In more than 90 per cent of all cases, the Moore Jig Borer and Jig Grinder provide the most accurate and efficient means for inspecting their own work. The advantages include:

1. Considerable saving of time results from checking the piece in the original setup, *while still in the machine.* In addition, should an error be discovered—the work is *in position* for correction.

2. The same directness which reduced sources of locational error in comparison to toolmaker error also reduces the number of steps and sources of error in inspection.

3. The machine's measuring system is fully as accurate as *any* standard that might be used in its stead. The inspection values, determined by means of this system, are likely to be *more* accurate than those attained by any other shop standard because reorientation errors are eliminated.

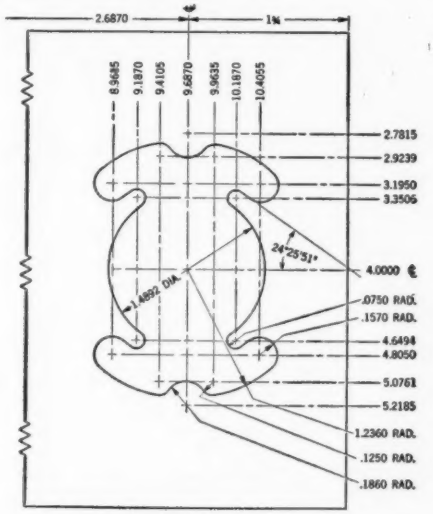
4. The machine spindle provides a rotatable mounting for an indicator. Holes can be picked up directly in this manner, without use of plugs or pins. Out-of-roundness, often mistaken for out-of-location, is easily detected and identified. Full 360° rotation of spindle provides a double indicator reading of any error, thus increasing readability. By vertical movement of the spindle and indicator the shape of the hole can be explored, revealing taper, bellmouth or barrel shape.

5. Contours, one of the most difficult, time-consuming jobs of inspection, can be rapidly and accurately measured and inspected by use of the "indicator measuring" technique. The drawing at the right shows dimensions to be inspected on a complex contour. Of this job it might well be said, "How *else* would you inspect it?"

6. Work jig bored or jig ground to *polar* coordinates on the rotary table can be inspected to *rectangular* coordinates in the same setup. This not only provides a check on possible errors in settings; it eliminates sources of rotary table errors.

7. Paradoxically, the machines will actually inspect somewhat more accurately than they will locate, under most conditions. During inspection, both machine and work are free of vibration, stresses and temperature differentials, so that the accuracy of the measuring system is undiminished.

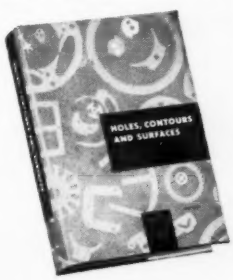
8. A microscope, interchangeable with the indicator in the machine spindle, can pick up surfaces and small holes which cannot be conveniently reached with an indicator point.

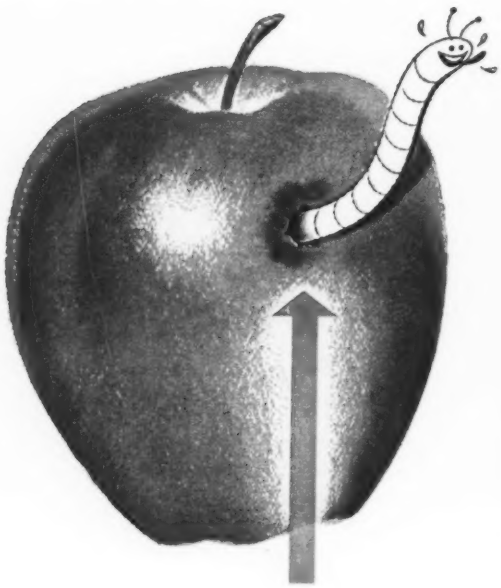


Without modern methods, this contour presents a serious problem to inspect as well as to machine.

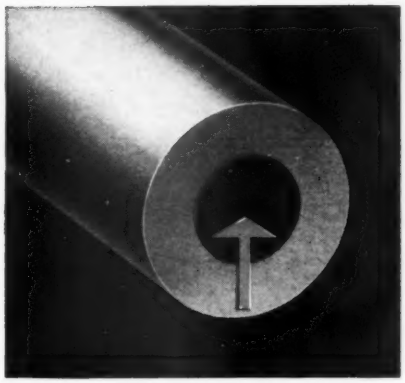
Get ALL the answers from this new, 424-page book

The information on this page is just a sample of the valuable, on-the-job aid you can get from Moore's *all-new* book, HOLES, CONTOURS AND SURFACES. Tells you how to produce tools, dies and precision parts *the modern way.* 424 pages, 495 illustrations. 184 pages of Woodworth Coordinate Location Tables from 3 to 100 holes. Price only $5 in U.S.A., $6 elsewhere. Send check or money order to Moore Special Tool Co., Inc., 726 Union Ave., Bridgeport 7, Conn.





a hole here makes waste...



a hole here saves waste

Crucible Hollow Tool Steels save waste — time and money — whenever you need ring-shaped parts or tools with a center hole. For the hole is in the piece when you get it! You eliminate drilling, boring, rough-facing operations — save machine capacity for productive work.

And you can get Crucible Hollow Tool Steels in *any* of our famous tool steel grades . . . in bar lengths or saw cut to your individual requirements. They are made in practically any combination of O.D. and I.D. sizes. What's more, delivery is *immediate* with Crucible's popular KETOS oil-hardening, SANDERSON water-hardening, AIRDI 150 high-carbon high-chromium, AIRKOOL air-hardening, and NU DIE V hot work tool steel grades from warehouse stocks.

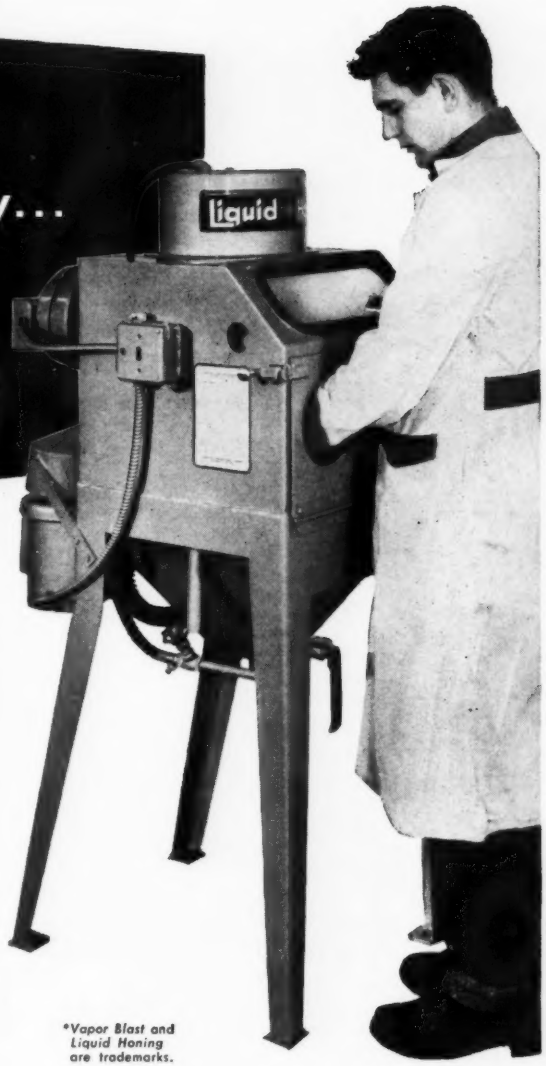
Next time you have an application with a center hole, let your Crucible representative show you how these hollow tool steel bars can save you money and time. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

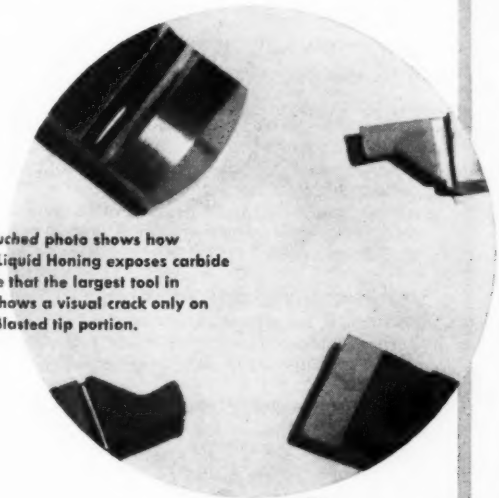
CIRCLE INFORM-A-GRAM KEY NO. 38

Detect Carbide Cracks Quickly, Positively... with V-B Liquid Honing*



Now you can prevent profit losses traceable to new or reground carbide tools that break because of cracks, porosity and other imperfections. Liquid-abrasive action flushes out the fine sintered material which, under grinding heat and pressure, often seals minute cracks and prevents detection by other methods. After Liquid Honing, fissures and other defects become *visually apparent* in a satin matte finish that remains dimensionally the same as the previous finish. Liquid Honing inspection processing is fast and thorough — more than 100 single-point tools per hour. And those tools, if not defective, last longer and cut better because they're free of burrs.

*Vapor Blast and Liquid Honing are trademarks.



This *unretouched* photo shows how effectively Liquid Honing exposes carbide cracks. Note that the largest tool in the group shows a visual crack only on the Vapor Blasted tip portion.

A Liquid Honing machine for carbide crack detection serves you in many other ways. Use it for surface conditioning, finishing, cleaning or descaling — often at production savings of 65% to 80%!

Write for complete information on case histories and low cost — only $550 to $1500 for a standard machine. And send a sample tool or part for free demonstration processing.

VAPOR V-B BLAST
MILWAUKEE, WISCONSIN

VAPOR BLAST MFG. CO.
3131 W. Atkinson Ave. • Milwaukee 16, Wis.

CIRCLE INFORM-A-GRAM KEY NO. 39

NEW TOOL

drills small holes to .001"

without specially trained operators

DUMORE®

PRECISION MICRO-DRILL

Here's easily controlled, accurate micro hole drilling at low cost!

Now anyone can become an expert micro-drill operator — because of these outstanding Dumore features that make drilling holes to .001" easy. Super sensitive feed; accurate and instant centering magnetic chuck; micrometer depth control; two-way table travel; 10-power viewer and spot light and speed control box; table drilled and tapped for holding fixtures — all combine to give you consistently lower micro hole drilling costs with less scrap.

ACCURATE INSTANT CENTERING MAGNETIC CHUCK provides fast changeover to different drill sizes without stopping the machine. Drill is set into a collet, placed against the magnetic rotating driver and quickly trued to the hole with a finger nail or a pencil point. Accurate concentric drill rotation results every time with less drill breakage and scrap losses.

SPEEDS CONTROLLABLE TO 17,000 R.P.M. provide the correct speed for any drill size up to ⅛". Available speeds permit extremely accurate drilling performance for the drill size range from .001" up to ⅛".

TEN-POWER VIEWER AND SPOT pin point the work for full, clear vision on the smallest holes.

MULTIPLE-HOLE UNIT

TWO-WAY TABLE TRAVEL PROVIDED . . . Side to side and front to back — both adjustable from zero to 1⅛". Two easy-to-read dials indicate travel; convenient knobs permit quick location and exact spacing between holes. Saves set-up and layout time.

only $565.00
Model 27-021

Includes Drill Press, Speed Control Box, Viewer and Spot Light, Micrometer Depth Control, 2 Counter Balances, and Magnetic Chuck Kit. 115V, AC, 50/60 cycle.

Single Hole Unit, Model 27-011, only $295.00

WITH STATIONARY TABLE

Has all the fine features of the Multiple-Hole Unit except two-way table travel mechanism. For single hole drilling where table movement is not required. Includes Drill Press, Speed Control Box, Viewer and Spot Light, Micrometer Depth Control, Counter Balances, Magnetic Chuck Kit. 115V, AC, 50/60 cycle.

See Your Local Distributor for a Demonstration, NOW!

DUMORE® PRECISION TOOLS

AUTOMATIC DRILL UNITS • TOOL POST AND HAND GRINDERS

1304 Seventeenth Street, Racine, Wisconsin

CIRCLE INFORM-A-GRAM KEY NO. 40

MOTCH & MERRYWEATHER CUT-OFF BLADES and SLITTING-SLOTTING SAWS

Triple-Chip

From a very small slitting saw to a very large cut-off blade, Motch & Merryweather makes them all.

STOCKING DEALERS in all principal cities.

FACTORY-APPROVED SERVICE in many industrial centers.

ENGINEERING SERVICE to solve your specific problem.

Challenge Motch & Merryweather to demonstrate that the Triple-Chip Method will cut off stock in faster time, with greater precision, and at lower cost than any other method. Rely upon Motch & Merryweather to engineer your job, recommend the right blade, and follow through. Our wide range of blades and saws is coupled with a wealth of technical experience and data on every phase of the circular sawing of all metals. Motch & Merryweather sales engineers in conjunction with dealers nation-wide stand ready to analyze your exact requirements and recommend a complete, profitable solution. Ample, strategically located stocks insure satisfactory delivery.

• • •

Also Kroslok Face Milling Cutters and Shell End Mills. Also Triple C Grinding and Cutting Coolants and Machine Cleaner.

THE MOTCH & MERRYWEATHER MACHINERY CO.

Cutting Tool Manufacturing Division

1250 EAST 222nd STREET, CLEVELAND 17, OHIO

TRIPLE-CHIP CIRCULAR SEGMENTAL AND SOLID CUT-OFF BLADES • TRIPLE-CHIP SLITTING SAWS • KROSLOK FACE MILLING CUTTERS AND END MILLS • TRIPLE C GRINDING COOLANT • TRIPLE C MACHINE CLEANER • TRIPLE C CUTTING COOLANT

CIRCLE INFORM-A-GRAM KEY NO. 41

Cut DIE COST WHERE IT COUNTS MOST...

...BEFORE the die gets in the toolroom

Nothing makes a diemaker meaner than a sticky punch holder. Count the number of times he removes that holder building up a die and it's foolish to save a few dollars buying second-rate die sets.

That can't happen with Detroit Die Sets because . . .

. . . from start to finish, under one roof, Detroit Die Sets are continuously inspected for accuracy, whether it's turning a shank or superfinishing a guide pin. Misalignment doesn't have a chance.

. . . we are constantly working to improve our die sets. Recently developed ball bushings are an example. Extensive testing, in our own and customers' plants, has proven their value on certain applications. Now, they're available on Detroit Die Sets to extend production runs as well as making the diemaker's job an easier one.

Details on the use of ball bushings plus other helpful information on cost-cutting Detroit Die Sets are available upon request. Write today, or see your local representative—he's as near as your phone.

Offices in Principal Industrial Centers

Detroit DIE SET CORPORATION

2895 WEST GRAND BOULEVARD • DETROIT 2 MICHIGAN

FILMS TO SEE

"Extending the Range of Modern Surface Grinding" explains the production applications of surface grinding. New features and attachments that permit the use of the grinder for many jobs other than ordinary flat grinding are examined. Also covered in the 16 mm sound-color film are various methods of dressing the grinding wheel to achieve flat or shaped surfaces. Machine features that permit flat or form grinding on an automatic basis introduce a section on production operations. To arrange for a showing of this film, contact the Film Div'n, The DoAll Co., Des Plaines, Ill.

Fifty material handling educational and training films are available from members of The Material Handling Institute, Inc. These films are listed in the new MHI catalog which is supplied by The Material Handling Institute, Inc., Suite 759, 1 Gateway Center, Pittsburgh 22. The films cover all phases of material handling and are grouped according to 10 major categories. Included in the catalog is a descriptive resume of each film together with its running time and "where to send" information.

The use of optical tooling in industry is concisely presented in a color film by means of animated drawings and working models of optical instruments and tooling bars. The movie covers the principles of optical tooling, illustrates some of its general applications and shows its advantages over older mechanical methods. Also illustrated are specific industrial applications in research, design and production. "Optical Tooling," a 16 mm sound-color film with a running time of 35 min, is issued on a free-loan basis by Charles Bruning Co., 4700 Montrose Ave., Chicago 41.

Two films have been released by E. W. Bliss Co., 1375 Raff Rd., S.W., Canton, O. The first, "The 1000th Bliss Transfer Feed Press," covers the complete operation of a 250-ton press that produces a finished automobile starter part by automatically passing a blank through an 11-station series of dies. The transfer feed mechanism and automatic safety guards are detailed. Transfer feed presses in the appliance industry are covered in the second movie. In this one, a 700-ton transfer feed press makes electric refrigerator crisper pans from coil stock at the rate of 12/min. Every step through the seven die stations is detailed.

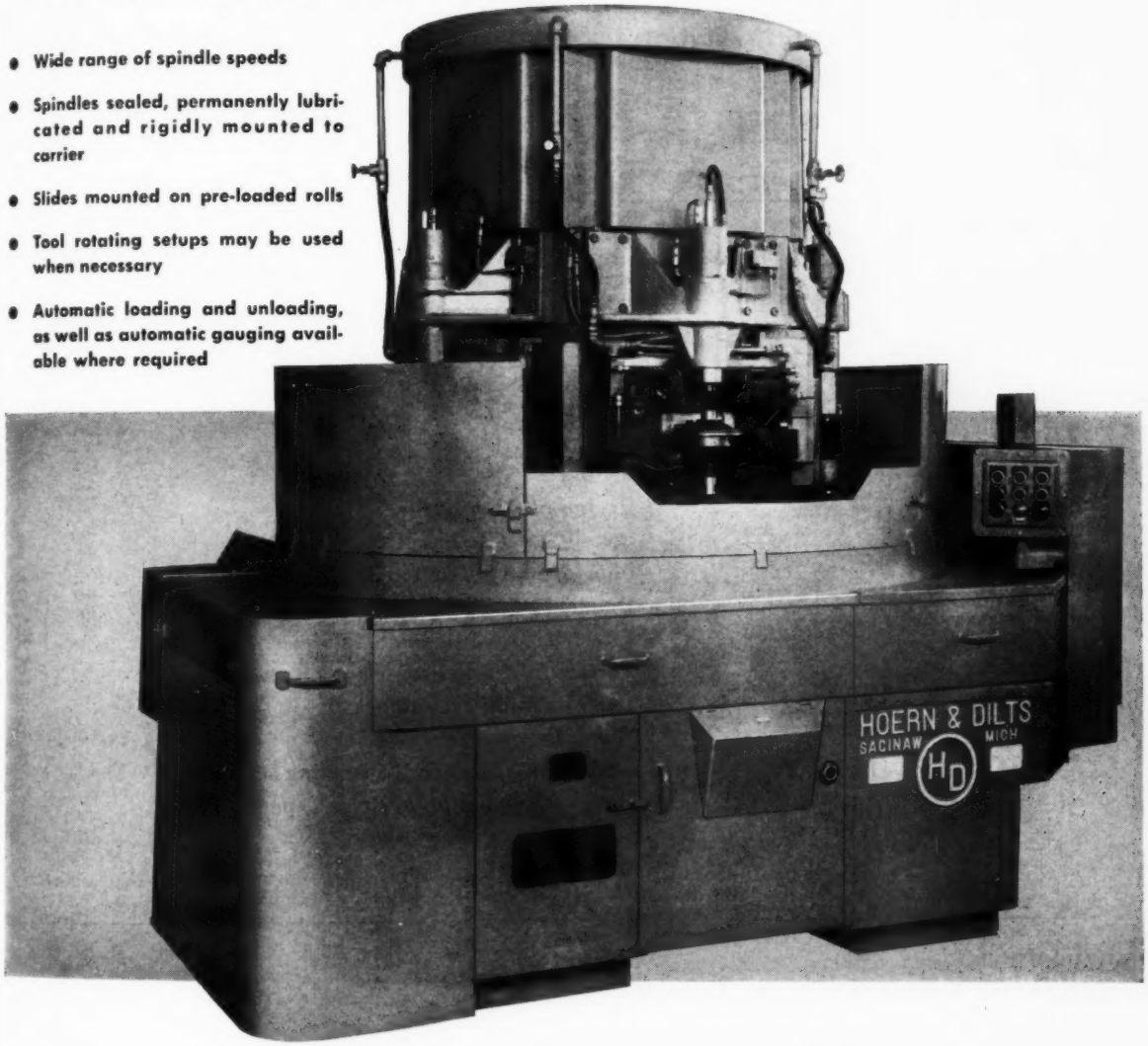
for your precision boring . . . .

5 times as many pieces every hour

Hoern & Dilts continuous boring machines have *five* sets of contour turning and boring slides, each serving one or two spindles and continuously moving around a central column. Slides and spindles travel together. Operator merely loads and unloads.

Pieces are completely turned, bored and faced in one circuit around the machine. One set of stationary cams actuating all slides provides absolute duplication of dimensions between stations.

- **Wide range of spindle speeds**
- **Spindles sealed, permanently lubricated and rigidly mounted to carrier**
- **Slides mounted on pre-loaded rolls**
- **Tool rotating setups may be used when necessary**
- **Automatic loading and unloading, as well as automatic gauging available where required**



Hoern & Dilts engineers will welcome the opportunity to cooperate with you on any high production finishing operation.

HOERN & DILTS DIVISION

The New Britain Machine Company • Saginaw, Michigan

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Lucas Machine Division
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Precision Horizontal Boring, Drilling and Milling Machines

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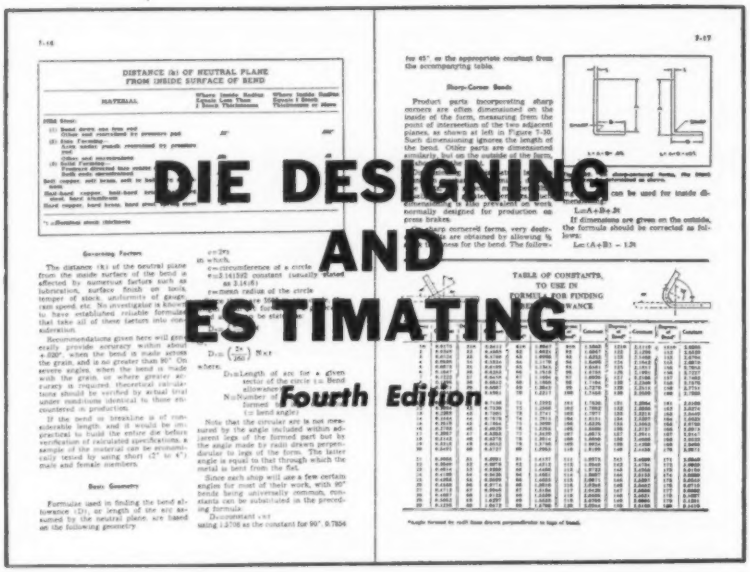

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- **Die Engineers**
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FOUND WHERE AIRCRAFT POWER AND CONTROLS TAKE SHAPE

GRAND RAPIDS GRINDERS

SUPER SABRE F-100
NORTH AMERICAN
AVIATION, INC.

Bendix
BENDIX PRODUCTS DIVISION
BENDIX AVIATION CORP.

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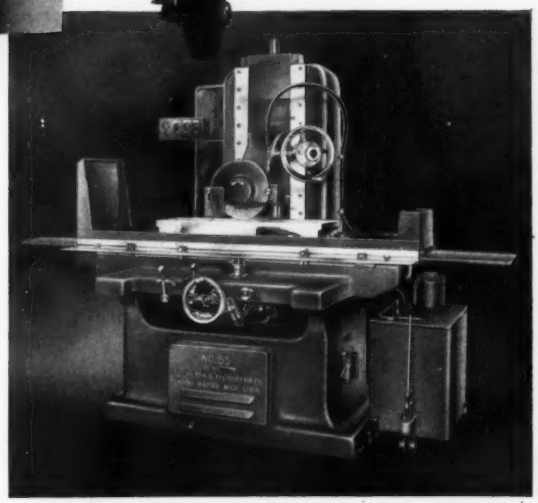
Precision is paramount in the manufacture of components for aircraft power and control. That's why these makers of precision parts have Grand Rapids Grinders in their toolrooms — for the utmost in precision grinding.

Model No. 55, for example, features one-piece column and base for permanent vibrationless rigidity. Longitudinal travel table and cross feed are hydraulically actuated. Wheel head has powered rapid vertical travel. And it's faster than any other grinder of this type and size . . . with variable table speed up to 125 fpm.

With these built-in precision features typical of all Grand Rapids Grinders, it's no wonder they're found in leading toolrooms.



GRAND RAPIDS NO. 55 HYDRAULIC FEED SURFACE GRINDER. Table speed up to 125 fpm. Working surface of table is 12" x 36". Vertical movement of wheel head is 18". Preloaded ball bearing spindle greased for life. Spindle speeds 1925 and 2500 rpm.

A note on your letterhead will bring full details.

GALLMEYER & LIVINGSTON

GALLMEYER & LIVINGSTON COMPANY

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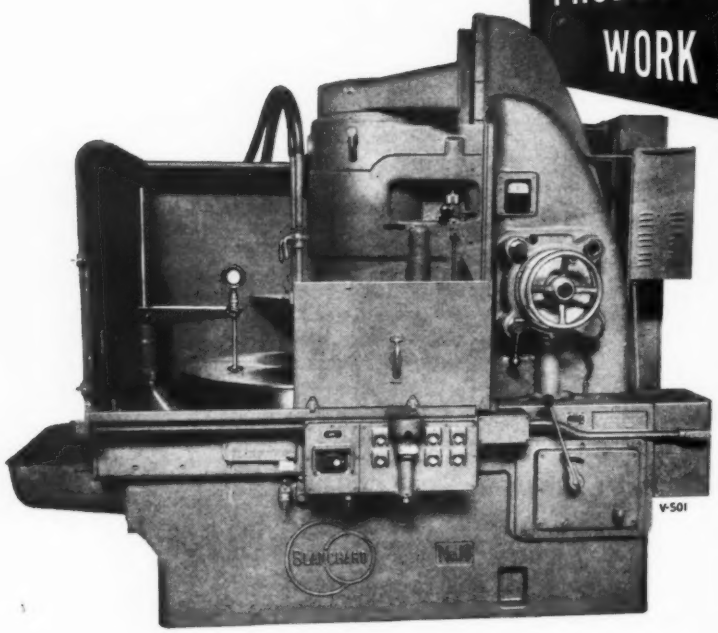
for BEST results in surface grinding...
PUT IT ON THE BLANCHARD

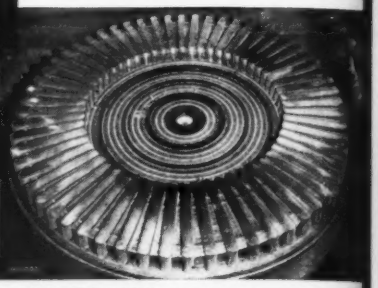
PRODUCTION WORK



Blanchard Grinders are used throughout industry on surface grinding jobs that demand the utmost in production, finish and accuracy.

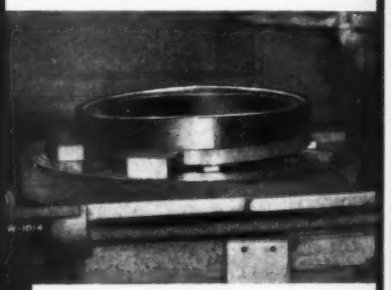
Whatever *you're* surface grinding, there's a Blanchard designed to do the job speedily and accurately.

SIDE PLATES. 9" x 18" plates ground from rough on No. 18 Blanchard with 36" chuck. Stock removal 1/16" to 1/8" per side. Held flat within .003", parallel to .001", and to dimension tolerance of ±.001". Production: 30 surfaces per hour.



CONNECTING LEVERS. Cast iron levers ground in special magnetic fixture with pins located in "vee's". Stock removal per side is 1/32" to 1/16"; must be flat and at right angles to pins. No. 18 production: 180 pieces per hour, compared to 20 pieces per hour by former method used.

MAINTENANCE AND ODD LOT WORK



HARDENED STEEL PUNCHES. This 24-13/16" dia. punch, reground on a No. 18, is centered radially on 36" magnetic chuck. Duplicate circumferential and radial shear reliefs are generated with two setups.

GRANITE SURFACE PLATES. A No. 18 Blanchard reconditions this 18" x 34" granite surface plate by grinding it flat within .0002". 3/16" of stock is removed in 5 hours.

PUT IT ON THE BLANCHARD

Send for free copies of "Work done on the Blanchard", fifth edition, and "The Art of Blanchard Surface Grinding".

THE BLANCHARD MACHINE COMPANY
64 STATE ST., CAMBRIDGE 39, MASS., U. S. A.

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Why the trend to heat-treated cap screws in the heavy equipment industry?

Chicago Screw engineers worked with leading manufacturers to develop the high-strength, heat-treated screws that take more punishment and greatly reduce fastener costs

Strength, and the ability to withstand severe punishment, are prime requirements for fasteners used in heavy equipment. As a leading fastener source for most of the top manufacturers of heavy equipment, CHICAGO SCREW conducts a thorough research and development program aimed at steadily improving fastener performance.

A major result of this program is the development of the CHICAGO *carbon-restored* heat-treated cap screw, now replacing bright-finish fasteners for most heavy equipment applications. Design engineers have found the far greater tensile strength of the heat-treated fastener (see chart) gives a better fastening with fewer—or smaller—screws. This means less weight . . . and a considerable reduction in fastener costs.

In addition to greater strength, CHICAGO heat-treated cap screws prove far superior in withstanding fatigue, wear, shock and vibration. This is because a major cause of fastener failure—a surface layer of soft, decarburized steel—is eliminated by our unique Carbon Restoration process. Vital surface carbon is restored in a scientifically controlled process during final heat-treating, producing a fastener that's uniformly hard from core to surface.

Our engineers will be glad to advise you on designing to best take advantage of heat-treated cap screws. For complete information on cost savings you can get in your products . . . and a detailed version of the condensed tensile strength chart at right . . . drop a line to our Standard Products Division.

HOW TENSILE STRENGTH COMPARES

Diameter (Coarse Thread)	Bright Cap Screws Tensile Strength (Pounds)	Heat-Treated Cap Screws SAE Grade 5 Tensile Strength (Pounds)
¼	2,150	3,810
5/16	3,550	6,270
⅜	5,250	9,280
7/16	7,200	12,720
½	9,650	17,000
9/16	12,400	21,800
⅝	15,400	27,070
¾	21,400	40,100
⅞	29,500	53,040
1	38,700	69,590

THE CHICAGO SCREW COMPANY

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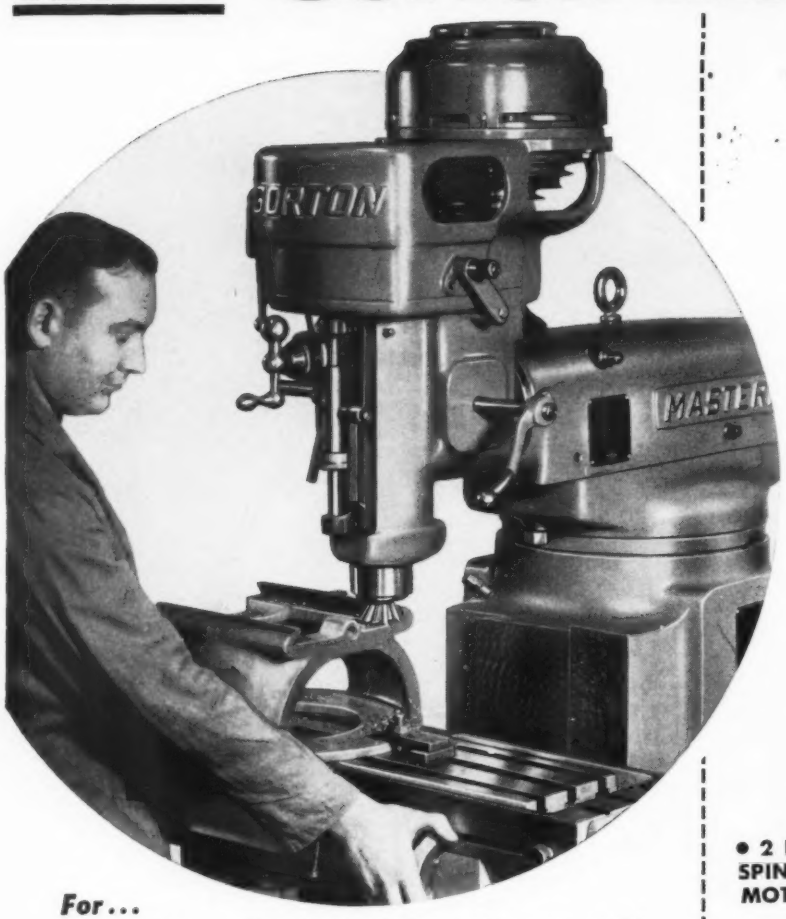
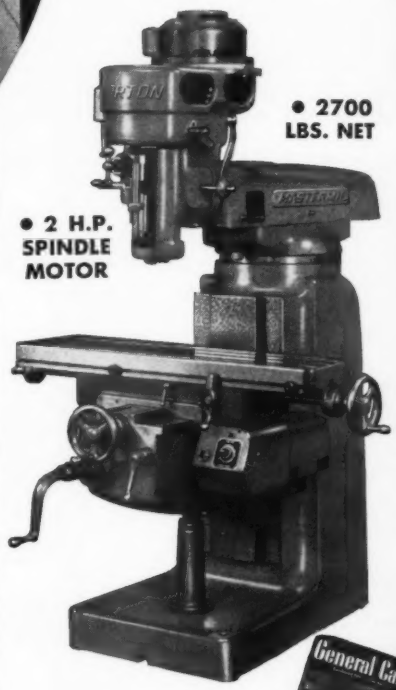
NEW Gorton Mastermil



- Precision spindle; 10 speeds, 80-5600 R.P.M. standard
- Designed and built to provide sustained accuracy
- Longitudinal Feed, 22 inches
- Saddle length, 24 inches
- Cross feed, 10½ inches
- Vertical feed of knee, 15¼ inches
- Spindle feed, 4 inches



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Also available...

Infinitely variable spindle feed from ¼ inch to 8 inches per minute.

Infinitely variable table feed (longitudinal) in 4 ranges: from ½ inch to 60 inches per minute.

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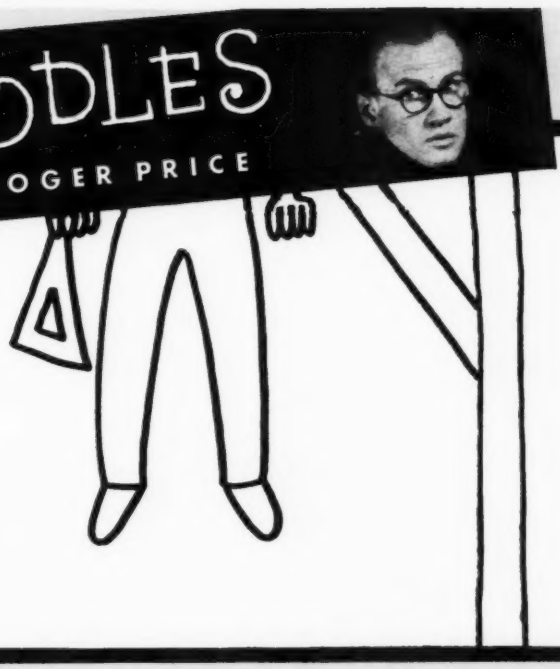
DROODLES

by ROGER PRICE



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Floor Model FC-30

Floor Model FC-14

Table Model TC-14
(Vertical Inspection)

"HIGH-STRUNG ENGINEER"

This cleverly-drawn Droodle is just a joke, because everyone knows that engineers really aren't high-strung at all. They're all rugged, handsome, good-natured chaps who puff placidly on bulldog briars while they're doping out various ways to square the circle, and how to get another year out of the family jalopy. Oh yes, I was an engineer once! Until one day the boss, who was inspecting one of my blueprints, remarked "Price, you're funny!" On the spot, I decided to become a humorist. That's the very same spot I was fired on, incidentally.

Not at all incidentally, I'd like to put in a good word for a friend of mine, the Jones & Lamson Optical Comparator. This precision-built instrument is used throughout industry to inspect and measure all sorts of parts and objects. The J&L Comparator is speedy, and accurate to .0001". It's extremely flexible, too . . . can be used for the toughest inspection jobs, and pays its own way both in production-line and job-shop work. Available in eleven bench and floor models. Get all the details on Jones & Lamson Comparators . . . write to Dept. 710 *today*.

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A J&L Comparator performs production-line inspection of form tools and gages. This helps to minimize scrap, and insures top quality in the manufacture of rock-drilling equipment.

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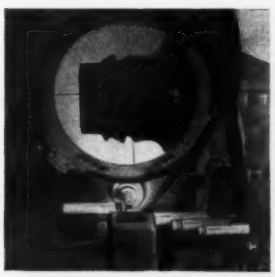

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JONES & LAMSON MACHINE COMPANY, Dept. 710, 519 Clinton Street, Springfield, Vt., U. S. A.

Please send me Comparator Catalog 402-C, which describes the complete line of J&L Optical Comparators.

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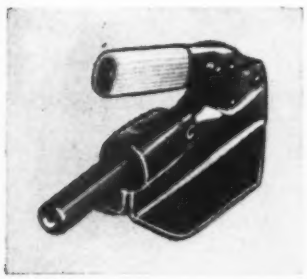

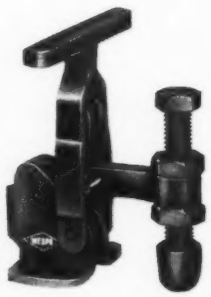

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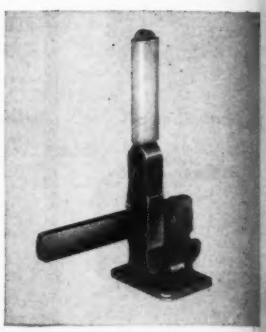

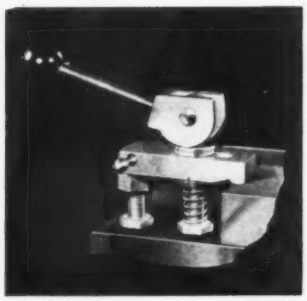

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159 SIZES

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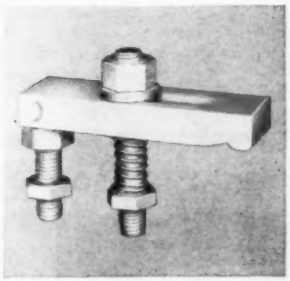

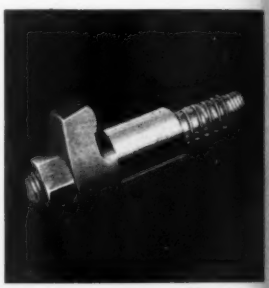

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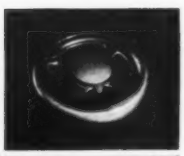
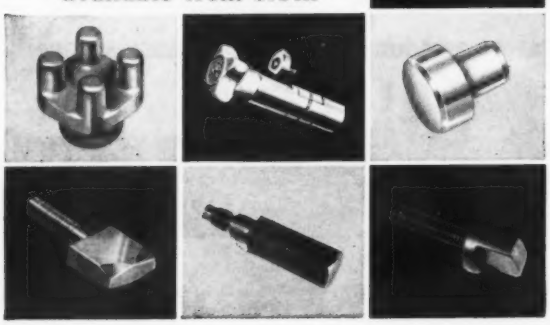
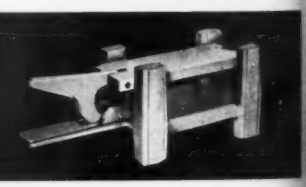
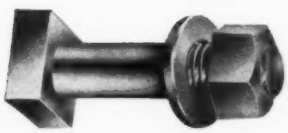




LEAF JIGS



Save 50% Designing Time and Toolmakers Cost.
23 Sizes, 1½" x 2" to 6" x 6".



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Made to J.I.C. Press Room Standards.

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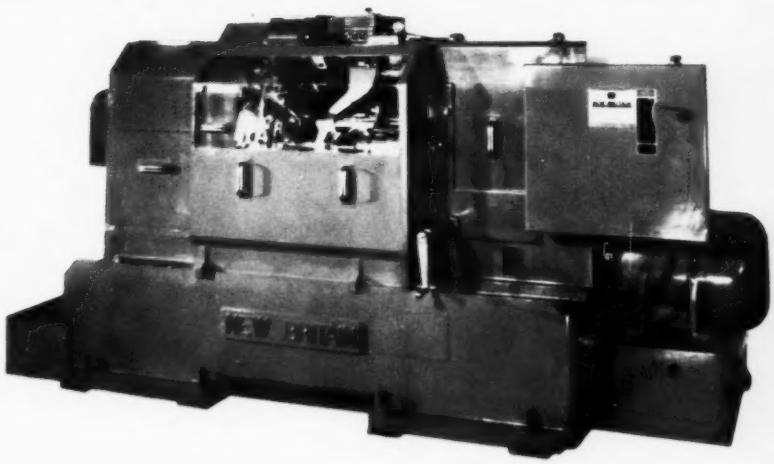
XI

WHEREVER YOU TURN
on multi-spindle bar machines
NEW BRITAIN HAS THE MACHINE FOR YOU

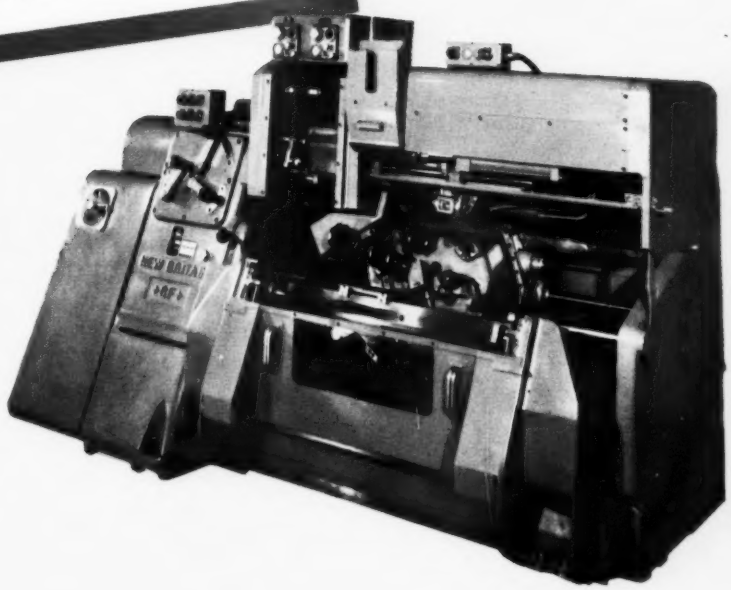
THE NEW BRITAIN MACHINE CO.
Model 62
Automatic Bar
Machine
NB



The new Model 62 New Britain bar machine has an independent radial cross slide in every position — opening new possibilities for effective tooling. New Britain "accuracy features" include spindle carrier lifting to eliminate wear during index, plus rigid locking of the carrier during the cutting cycle. Magazine loading available if desired.

WHEREVER YOU TURN
long or short runs
NEW BRITAIN HAS THE MACHINE FOR YOU

THE NEW BRITAIN MACHINE CO.
Model 11/70
New Britain +GF+
Copying Lathe
NB



The original New Britain **+GF+** copying lathe has grown into an extensive line, to meet the demand for the wide variety of applications for its better copy-turning principle. Regardless of length of run or the variety of pieces you make, you can use the New Britain **+GF+** profitably. Basic advantages are: fast setup, inexpensive tooling, elimination of the chip problem, minimum operator fatigue, and dimensional accuracy with good surface finish to reduce grinding allowances. Optional features include automatic re-cycling, automatic loading and ejecting.

WHEREVER YOU TURN

castings, forgings or pressed metal pieces

NEW BRITAIN HAS THE MACHINE FOR YOU

THE NEW BRITAIN MACHINE CO.
Model 810
Automatic
Chucking Machine
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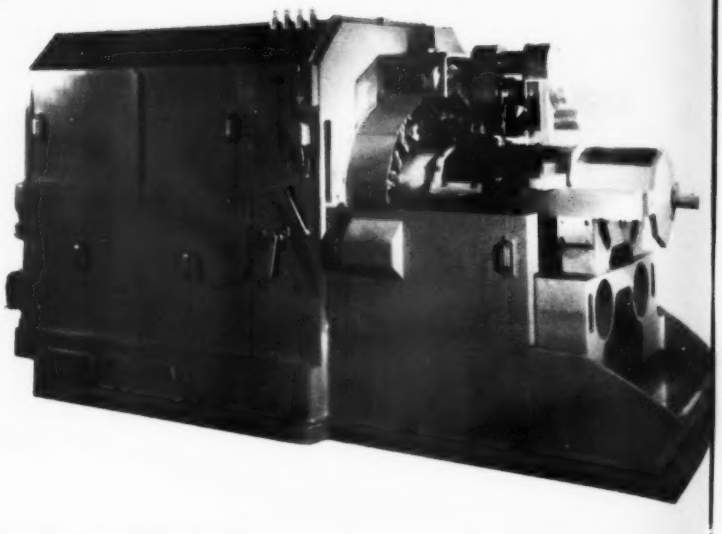


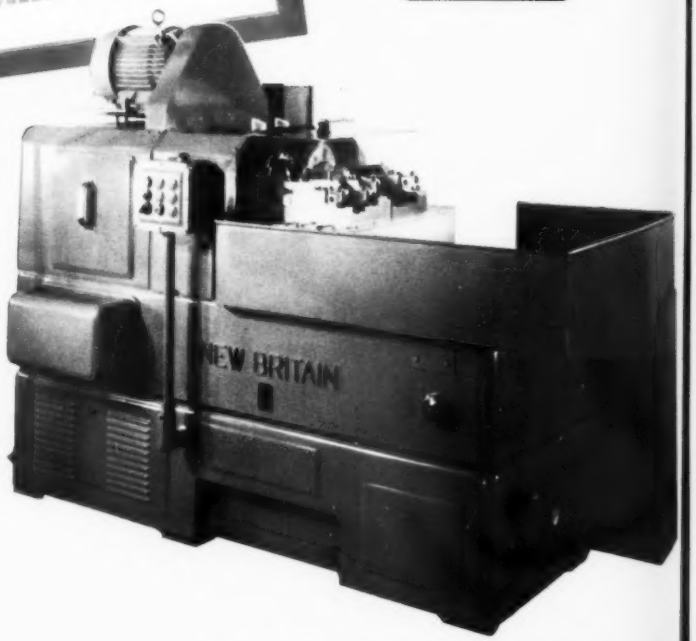
Versatility, accessibility, quick setup and sustained high production of precision parts are what you look for in an automatic chucker. New Britains are famous for these features all over the world. Perhaps you are also thinking of the possible savings which automatic loading, unloading and automatic gauging could effect. If so, you will want to learn about the imaginative use of automated production which New Britain engineers are applying to chucker work these days. You can now handle bigger pieces than ever on New Britains too — up to fifteen inches in diameter.

WHEREVER YOU TURN

or bore precision contour work

NEW BRITAIN HAS THE MACHINE FOR YOU

THE NEW BRITAIN MACHINE CO.
Model 37
Precision Boring
Machine
NB



New Britain precision straight and contour boring machines provide a new approach to machining parts that would be problem pieces on any other type of equipment. These simple, fast, accurate machines require minimum attention and utilize inexpensive single point tools. They make the most profitable use of automatic loading, gauging and tool adjustment where these features fit the job requirements. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

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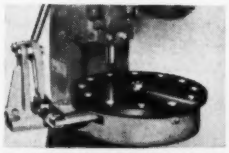

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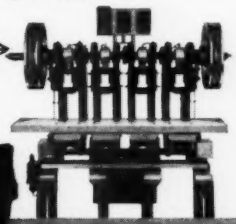

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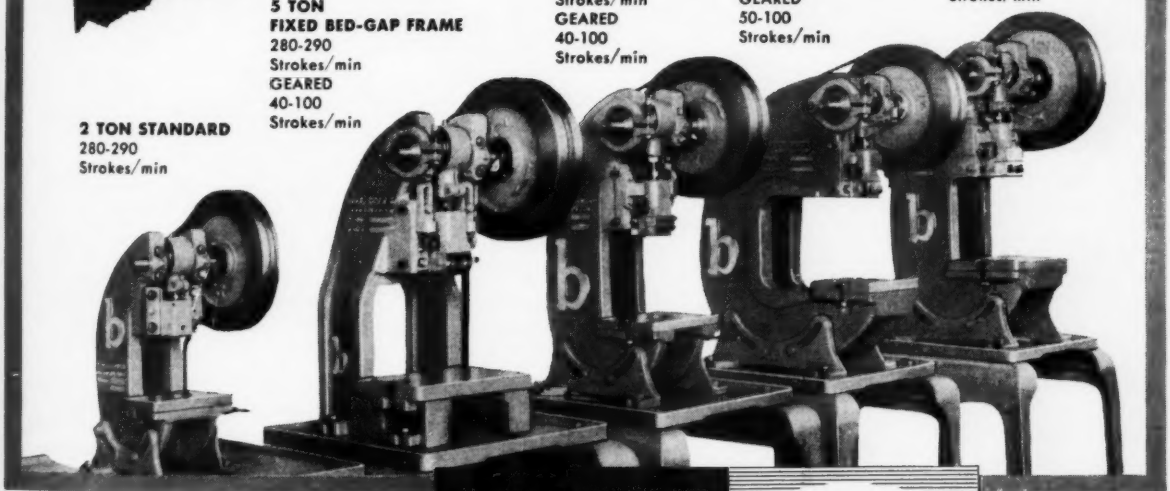

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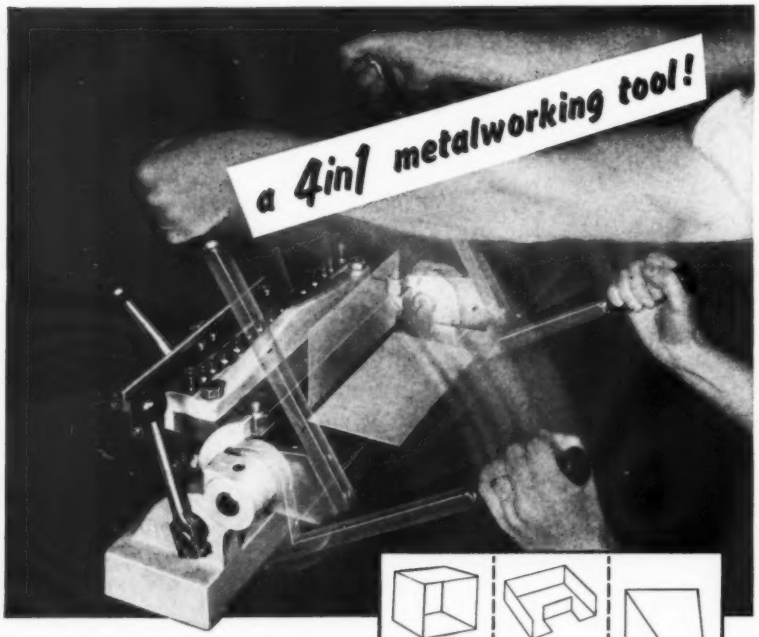

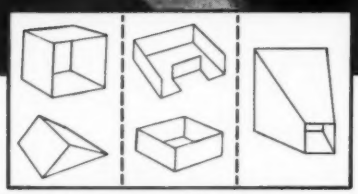

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BRAZING: "Ceramic Jig Blocks Speed Up Brazing Operations, Reduce Tooling Costs" by Herbert Schwartz, Technion Design & Mfg. Co. 58

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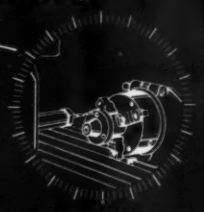

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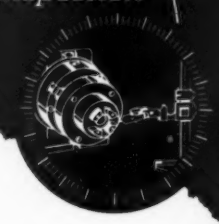

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editorial:

The Trend to Modules

UNDER THE TITLE of "Automation to Grow Down" we said on this page for March 1953:

"Ordinarily we think of things as growing up. As we speculate on the future of automation we are prone to think of it as growing down; down to the smaller plants and smaller products; down to them from the gigantic automobile plants, which have been proving grounds for automation."

Since those words were written, a short 3½ years ago, automation has made tremendous strides toward growing down.

Small manufacturers and manufacturers of small products have found that the techniques of mechanization and automation offer great rewards on two counts: economies in production, and gains in worker productivity. Both are vitally important.

In our free enterprise system economies in production are translatable into many material benefits for the manufacturer and his customers. These may come under the headings of reduced cost per piece, less scrap and rework, closer quality control, lowered selling prices, and an improved competitive position.

As important as these factors are, the gains in worker productivity which may be made by increasing mechanization of production and assembly operations, hold even greater promise of reward.

With today's toughening labor market and the attendant scarcity of experienced and skilled workers, anything that the manufacturer can do to engineer increased productivity into his production and assembly operations means fewer excursions into the labor market for non-existent skills. As our economy expands, the competition for our relatively diminishing working force becomes greater and greater, and the more a manufacturer can do to avoid this headache the more successful his operation may become.

The benefits of mechanized production and assembly operations accrue all the way down the line, for the original equipment manufacturer, parts supplier, service personnel, and end user.

Nowhere is this more evident than in the electronics industry. Here, the modular type of design and construction is rapidly taking over. This is evidenced in a goodly number of 1957 models of radio and T-V sets already on dealers' display floors. It seems only yesterday that the Bureau of Standards' development, Project Tinker-Toy, was disclosed to the electronics industry.

A module, or "building block," may be made up of a dozen or more components such as sockets, resistors, capacitors, and inductors. These are stacked, molded, dip-soldered, impregnated with insulation, and end up as compact, cube-like assemblies. They replace, in the radio or T-V chassis, what here-to-fore was a maze of individual "bits and pieces" connected by an exposed network of individually soldered leads and pig-tails.

The captive, or internal, circuitry of a module means that there is a minimum of external connections between the individual modules and other components in the chassis. In some instances modules have pin-type terminals and can be replaced as readily as vacuum tubes.

Although modules lend themselves to highly mechanized manufacture, their greatest contribution accrues from the simplification of service that has to be rendered in the field — by distributor, dealer or user. Here again, with an increasing shortage of fully qualified technicians in the electronics field, is a potential easing of the skill and experience bottleneck.

The idea of modular construction can be explored with profit by manufacturers of products much bulkier and heavier than electronics assemblies.

Sub-assemblies of hydraulic and pneumatic power elements lend themselves to stacking, compacting and integrating, to the extent that only the input and output lines have to be disconnected for service. Each module may be made up of the essential cylinders, valving and piping called for by the function to be performed. With stand-by modules on hand replacement can be made with a minimum of production downtime.

The module technique is particularly compatible in the field of electrical controls. With the advent of magnetic amplifiers and relays (with no moving parts) and other static components, control boards and terminal and distribution centers can be freed of undue complexity as to maintenance and repair.

Modular design and construction is one of our newest manufacturing concepts. Its applications to date demonstrate great economic justification both in easing the demand upon service skills and in the lessening of costly, non-productive downtime. Modularization is worthy of exploring and exploiting to the utmost.

E. Willard Pennington

editor

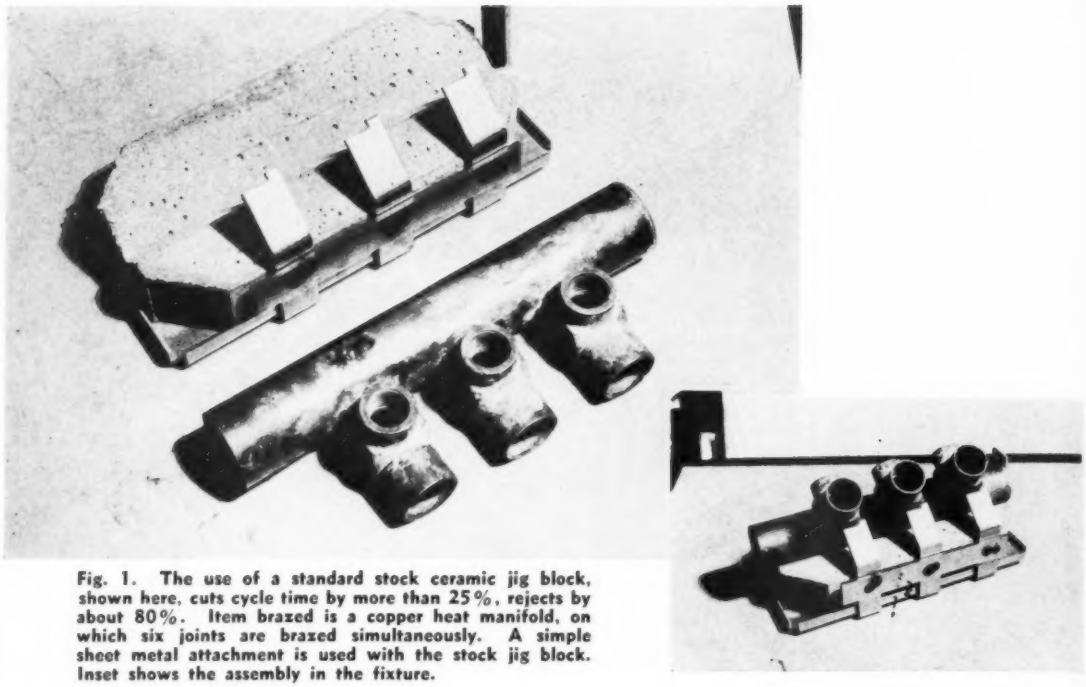


Fig. 1. The use of a standard stock ceramic jig block, shown here, cuts cycle time by more than 25%, rejects by about 80%. Item brazed is a copper heat manifold, on which six joints are brazed simultaneously. A simple sheet metal attachment is used with the stock jig block. Inset shows the assembly in the fixture.

Ceramic Jig Blocks

• Speed Up Brazing Operations
• Reduce Tooling Costs

by Herbert Schwartz
President
TECHNION DESIGN & MFG. CO.
New York, N. Y.

TODAY, THE MANUFACTURER is faced with a constantly upward spiral of costs. To operate competitively, he must control these costs without impairing the quality of his operations, must, in fact, produce better products at costs lower than ever before. One method of economizing while increasing the quality of the end product is the use of modern brazing techniques for joining metals.

Brazing in general, and silver brazing in particular, are accepted joining practices in many metalworking plants. Brazing permits the joining of similar and dissimilar metals, in thick and thin sections, at relatively low temperatures; thus preserving the physical properties and grain structure of the metals.

By brazing, the manufacturer can combine relatively simple pieces and eliminate subsequent machining operations, or he can join stamped pieces to comparatively inexpensive screw machine pieces. Thus, brazing offers tremendous opportunities for the redesign of parts and assemblies to lower unit cost of the finished product.

However, up to now the advantages inherent in the use of brazing have on many applica-

tions been outweighed by contingent costs of labor and fixtures. The primary factors involved in the high expense, on occasion, of conventional brazing may be classified as follows:

1. The difficulty in pre-positioning parts which are in any way complex or delicate.
2. The difficulty in brazing multiple joints simultaneously.
3. The difficulty in brazing blind and complex joints satisfactorily on a mass-production basis.
4. The need for highly skilled labor for manual brazing of complex assemblies.

If these drawbacks could be eliminated, at low cost, brazing would have an infinitely broader range of application as a cost-cutting assembly process.

Recently, a number of developments have been made that, taken together, offer one solution to the problem of low-cost, production brazing for even the most complex parts. Without any large-scale expenditure for capital equipment, these new developments can be applied in small plants as well as large ones.

These technical advances are not to be confused with production brazing machines, several of which are now in successful operation. Even the most automatic machines do not wipe out all the drawbacks of conventional brazing and, in addition, have limited applications and require cash outlays frequently outside the budget range of smaller plants. With the utilization of the improvements in brazing described here, a true "automation" process is created. It is not simple mechanization — the use of a machine to help in speeding the present process. It is rather the integration of a whole battery of machines and operations — eliminating operations and minimizing the roles of those that remain.

With this new "brazing by automation", the following results have been observed by our company:

1. Cycle time has been cut by more than 25%.
2. Rejects have been reduced by almost 80%.
3. Overall costs have been slashed by upwards of 50%.
4. Less demand has been made on the skill of the operator.
5. Setup time and tool wear have been cut appreciably.

Here's how it has been accomplished:

Overcoming the Problems of Pre-Positioning

Heart of the problem of speeding up brazing while lowering the cost is the means used for the efficient and inexpensive prepositioning of parts in furnace and induction heating equipment. Formerly, simple parts could be designed to be jigged for torch or induction brazing; but, for furnace brazing or long production run brazing, the problem frequently presented insurmountable difficulties.

Now, the manufacturer can pre-assemble his parts into a fixture for either furnace or mass-production brazing. Once this is accomplished, the automation of the remainder of the manufacturing process becomes simple. The fixture is fitted to a conveyor. The conveyor carries the fixture into a furnace. After heat treatment, the fixture, again by conveyor, is transferred from the furnace to a quenching bath. At this point, the part can be dislodged automatically from the fixture by gravity, and dropped into a pickle solution for cleaning. Another conveyor belt picks up the part for inspection, and it is then electroplated or finished in whatever manner is required.

As can be seen, the essential part of this automated process is the use of a fixture that will permit the rapid pre-positioning of parts prior to furnace or long-production-run brazing. Such a fixture must:

- Withstand extremely high temperatures.
- Withstand rigorous oxidizing conditions.
- Expand without buckling or warping.
- Absorb a minimum of heat from the brazing cycle.

Fig. 2. A standard ceramic jig block is shown here ready to braze a coaxial connector. These jigs, because of their low heat conductivity, prevent "jamming" — permit tolerances as close as ± 0.005".

TABLE I

MATERIALS AVAILABLE FOR BRAZING-FIXTURES

	METALS*	COATED METALS**	CERAMICS	CERAMIC COATED METALS
ADVANTAGES	1. Corrosion-resistant 2. Heat-resistant 3. Durable	1. Combines good physical properties of metals and alloys at lower cost than all-alloy fixtures 2. Heat resistant 3. Corrosion resistant	1. Low cost 2. No warping or buckling 3. Reflects heat 4. No alloy sticks to it 5. Corrosion-resistant 6. Heat resistant	1. Combines good physical properties of metals and ceramics
DISADVANTAGES	1. Expensive to fabricate 2. Absorbs heat 3. Brazing alloy tends to stick 4. Warps and buckles	1. Still expensive to fabricate 2. Warps and buckles 3. Brazing alloy tends to stick 4. Absorbs heat	1. Relatively fragile	1. Must be quenched slowly 2. Largely experimental at the present time

*Stainless steels, nickel-chromium alloys, etc.
**Carbon steel coated with nickel alloy spray.

- Resist tendency to press or weld to the assembly.
- Resist corroding the assembly or being corroded by it.

And, it must do all these things at low cost!

Now available to the manufacturer are the following fixture materials: metals, coated metals, ceramics, ceramic-coated metals. Table I outlines the advantages and disadvantages of each of these materials.

Now, a study of the chart shows that ceramics offer the best possibility for the manufacturer who is seeking a fixture material that will enable him to convert from hand brazing to production methods. With this in mind, the Technion Design & Manufacturing Company developed, after two years' research, a high-temperature super-refractory ceramic. Tests have shown that it is admirable for both furnace and induction heating . . . and has the durability to stand up for run after run.

Known as Sur-Braze, this new ceramic material meets all the conditions required for an "automation fixture" material. It withstands temperatures up to 1,800° F without warping or buckling. It is impervious to oxidizing conditions or the attacks of corrosive atmospheres. Its expansion coefficient prevents "jamming" in fixtures; this, in turn, permits closer assembly tolerances. Heat is reflected by the material and this shortens the brazing cycle and even permits the use of fuel with lower heating value — another means of cutting costs.

However, a suitable material alone does not solve the fixture problem. Most fixtures have to be custom-made — often an extremely expensive procedure. The new Sur-Braze, however, is available in standard jig blocks. These blocks can be readily mounted in production and come in a large variety of sizes to satisfy almost all requirements (Fig. 3). Although these jig blocks can be used over and over again, they are essentially expendable—allowing substantial reductions in brazing jig inventories. Expensive tool room maintenance can be eliminated and valuable storage space saved.

The use of inexpensive standard ceramic jig blocks — a tremendous advance over costly custom-made metal fixtures (see Table I) — is, perhaps, the greatest single stride toward true automation in brazing. It makes it possible for even the smallest manufacturer to afford the use of brazing as a means of increasing efficiency and reducing costs.

Typical stock ceramic jig blocks are 8″ long, 1¼″ high, and 4″ wide. Some have single ¾″ wide V-grooves, others have two ¾″ wide V-grooves intersecting at right angles, and some have recessed bottoms ½″ deep, 3″ wide and 7″ long. Because of their low heat conductivity, they eliminate "jamming". In a recent

TABLE II

COST PER ASSEMBLY

	Iron Fixture	Standard Ceramic Jig Block
Tooling	.200	.028
Labor	.016	.005
Rejects	.030	.006
Totals	.246	.039

Total Savings = .246 — .039 = $ .207 per assembly

case, this permitted assembly tolerances as close as ±0.005". They are particularly suitable for symmetrical tubular assemblies.

Currently, these jig blocks are making possible simultaneous brazing of six joints in a copper heating manifold assembly. Cycle time is cut by more than 25% and rejects slashed about 80%. In particular, they have solved the severe alignment problems previously encountered with metal fixtures which warped and buckled under heat. The ceramic, of course, is thermally stable. What's more, since the fluxes and the brazing alloys employed do not "wet" the ceramic, another hitherto insolvable problem — that of the fixture sticking to the assembly — has been eliminated. The entire operation has been speeded up 215% by the use of these new brazing aids.

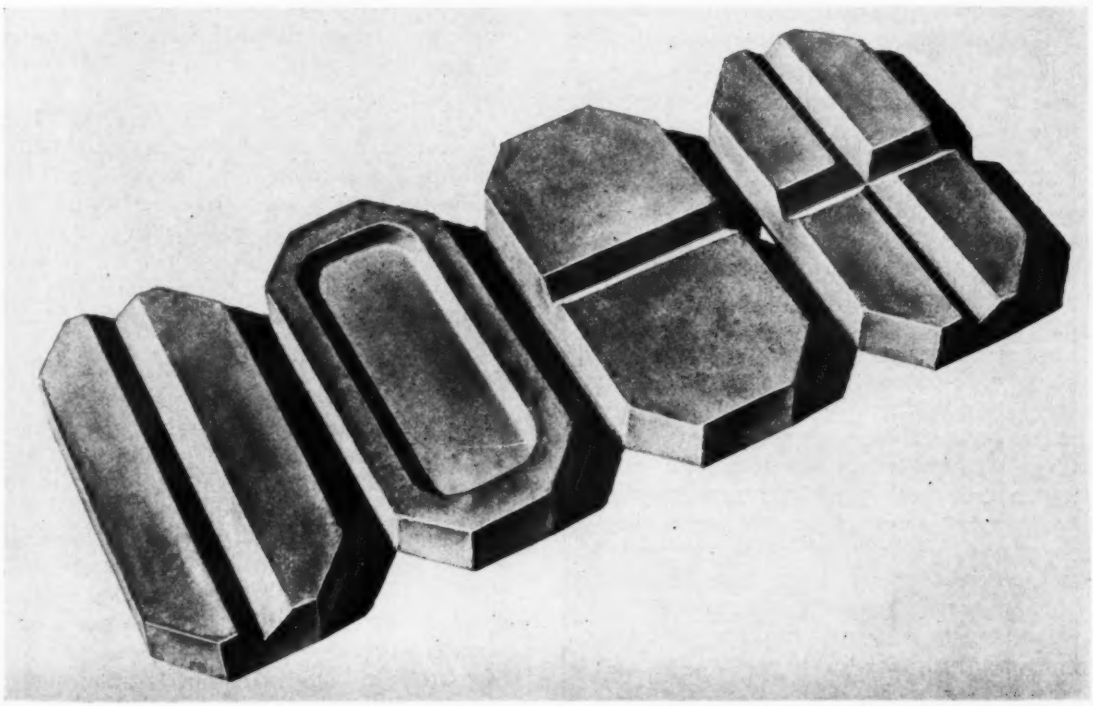
Additional help to the manufacturer is also available in a new line of ceramic pins and bushings. These were designed for the support of jig parts and assemblies, and demonstrate all the advantages of a "super refactory". They are available in quantities of from one piece to thousands. Maximum diameter is now 3", although larger parts are expected in the near future. Their dimensions can be held as close as ±0.001". Using these new ceramic pins and bushings in combination with the jig blocks, many fabricators are finding that screw-machine tolerances are now quite feasible when applied to brazed assemblies.

It is important to note, too, that all these new developments in pre-positioning are as applicable to induction heating as to furnace heating.

The New Pre-Positioning Aids in Action

An electronic component manufacturer recently completed a survey analyzing the sav-

Fig. 3. Typical ceramic jig blocks now available from stock at extremely low cost. Dimensions are 8" x 4" x 1¼". From left to right: single ¾"-wide V-groove; recessed bottom 3"-wide, 7" long, ½" deep: single ¾"-wide V-grooves intersecting at right angles.



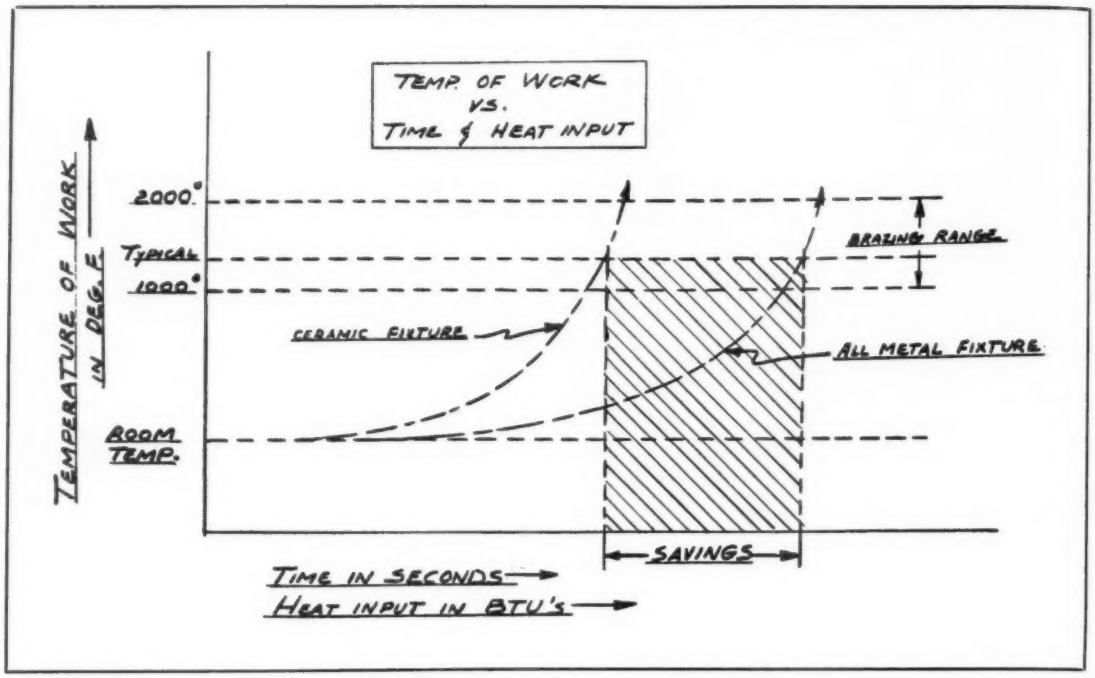


Fig. 4. Time-temperature curve for ceramic fixture vs. all-metal fixture.

ings in using standard ceramic jig blocks in his brazing operation.

The savings on 1000 assemblies was 20.7¢ per assembly compared to previous methods using machined iron fixtures. See Table II.

An aircraft equipment manufacturer realized tooling savings of 14.2¢ per assembly after switching from an iron fixture to a standard ceramic jig block. See Table III.

TABLE III

	Iron			Standard Ceramic Jig Block		
Cumulative Total Number of Units Brazed	1st Cost	Maintenance	Replacement	1st Cost	Maintenance	Replacement
1	$25	0	0	$50.30	0	0
100	0	$10	0	0	0	$ .30
200	0	0	$25	0	0	.30
300	0	10	0	0	0	.30
400	0	0	25	0	0	.30
500	0	10	0	0	0	.30
600	0	0	25	0	0	.30
700	0	10	0	0	0	.30
800	0	0	25	0	0	.30
900	0	10	0	0	0	.30
1000	0	0	25	0	0	.30
1000	$25	$50	$125	$50.30	0	$3.00
TOTALS						

1. Total Cost — Iron Fixtures (1000 pcs.) = $200 or $.20/pc.
2. Total Cost — Standard Ceramic Jig Block (1000 pcs.) = $58.30 or $ .058/pc. Savings = $ .142/pc.

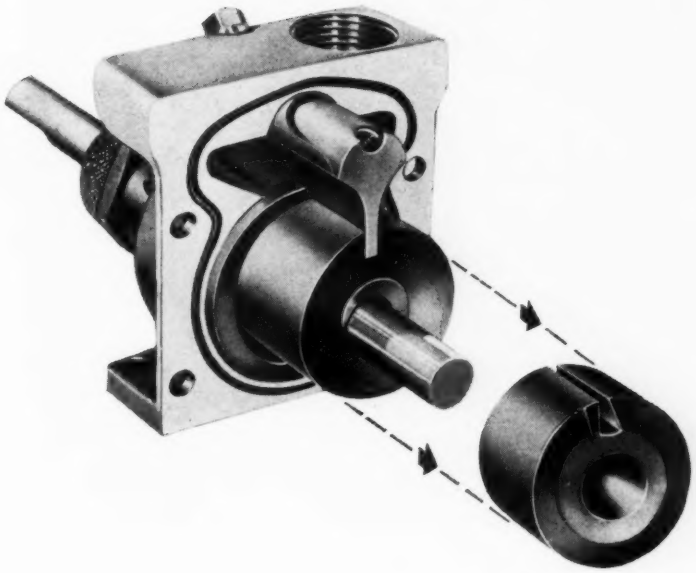
Note that the iron fixture corroded and warped, necessitating replacement after each 200 pcs. The ceramic jig blocks required no maintenance. After the first mold tooling cost, there were no maintenance costs. The expendable jig blocks were replaced every 100 assemblies at a nominal charge.

In addition to these savings, brazing cycles are shortened — one of the most sought-after features of the automation process — and less combustion gas is used. In order to illustrate this dramatic savings, comparative time-temperature curves have been drawn for the **same** assembly brazed in the conventional all-metal fixture, and then in a standard ceramic fixture. See Figure 4.

Note that the slope of the ceramic block brazing curve is steeper; the operator was able to reach the working temperature more rapidly. The refractory material reflects the heat input back into the work with little absorption of the heat energy by the fixture.

In many cases a standard ceramic fixture can reduce brazing cycles by 25% and at the same time improve quality! Using standard ceramic fixtures, one company was able to use a combustion gas with a **lower** heating value. The fuel savings in one year's operation amounted to $7500.

end



Many Eco pump parts lend themselves admirably to inspection by optical projection. Contours, corner angles and male thread forms appear on the screen greatly enlarged for direct comparison with master profile charts.

Optical Inspection Uncorks Bottleneck

ECO ENGINEERING COMPANY found itself in difficult straits several months ago when an abrupt speed-up was ordered to meet rising sales in its line of low volume chemical process pumps. Production facilities and the assembly department could be successfully reconstituted and reorganized to handle the increased volume, but the overtaxed inspection department, already working on an overtime schedule, could not keep pace with the accelerated activity.

The Newark, N. J. firm was operating a six-man inspection department to manually check vital pump parts such as impellers, eccentrics, shafts and impeller guides to within specified tolerances which may vary in latitude with the part and its function from 0.001″ to 0.0005″. This assures precision fit and thus complete interchangeability.

The distinguishing feature of Eco's pump is the broad range of accurately mated and standard non-metallic impellers available with a standard housing. However attractive this feature is in marketing the equipment to the chemical processing industries, great pressure is, at the same time, thrown squarely on inspection.

Doubling the staff to absorb the work load would have been economically unfeasible and no other means of speeding the manual inspection procedure, without reducing the quality of work, seemed practical. The problem was quickly coming to a head when a Jones & Lamson Model BC-14 optical comparator was installed. Within five months after it was acquired, the department has been able to assign five inspectors to other duty despite the speed-up. Only one semi-skilled operator is now needed to inspect the expanded volume of components flowing from production. As an example of the new visual system's effectiveness, 2000 eccentrics which were formerly checked in two ten-hour days, can now be passed through in one-eighth of that time. Inspection, the pace setter, now has the capacity of absorbing all current and contemplated output, thanks to switching to a visual technique.

The great flexibility of Eco's optical comparator extends its daily application far beyond routine checking of stock parts, and it has found limitless use for nearly every gaging requirement involving dimensions, complicated forms, and contours.

A series of projection screens, some graduated for linear measure, some for angular, enables the operator to accept virtually every measurable outside dimension for accurate sizing. A system of interchangeable lenses magnifies from 20:1 to 50:1, giving sharply defined enlargements on the ground glass screen

Fast-working setups can be made on the Jones & Lamson comparator by means of such standard accessories as the micrometer measuring table and precision v-blocks. With the table and v-block once oriented with the ruled projection screen, inspection of a batch of similar workpieces can be performed as fast as the operator can position and remove the pieces.

that enable the operator to discern minute deviations. A clear, bright screen, hooded from incidental light, provides fatigue-free reading, and a work-holding measuring table provides quick adjustment to locate the specimen in the field of view.

In checking a threaded member, for example, the optical comparator will swiftly determine minor diameter, major diameter, truncation, angles (with protractor), seating point (to determine undercut for tight mate), pitch, and pitch diameter. The visual method eliminates a dozen hand operations that could be accomplished with speed by only the most dexterous and highly skilled, and does away with mathematical formulation, conversion of data, sine bar and indicators, plus a long list of fixtures. Fifty screw threads can now be checked in the time it formerly took a skilled inspector to accurately measure but one.

Eco not only uses its optical comparator for production line work but for precision inspection of the initial run from each major machining operation. Each setup is sampled from time to time by contour projection to assure proper run-off of production parts from each of the steps in the machining process. In this way, rejects are kept at a minimum, and overall efficiency and tight coordination is facilitated.

So successful has been Eco's optical comparator in inspection and general shop applications that full credit is given to this one method for attaining a substantially higher level of output, a level that would not have been reached in so satisfactory a manner without it.

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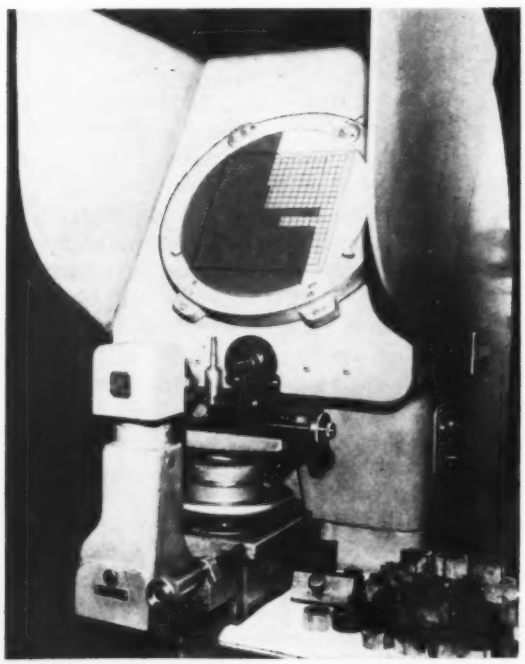


The ruled increments on the screen can be so related to the degree of optical magnification that they show at a glance whether significant dimensions on the workpiece are within tolerance. The many dimensions on this workpiece that can be checked simultaneously by the comparator method would represent time-consuming, expensive and laborious setups by strictly mechanical means.

Suggestions for MACHINING TITANIUM

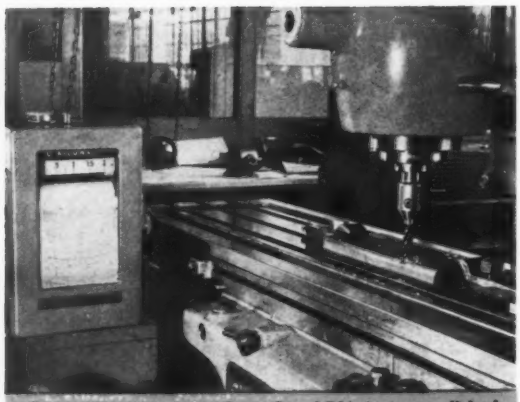
by Charles G. McPartland
Cutting Tool Engineer
PRATT & WHITNEY COMPANY, INC.
West Hartford, Connecticut

IN SPITE OF THE FREQUENT MENTION of the problems encountered in machining titanium, relatively few in the metalworking industry have had actual experience with the metal. Those who have been successful have patiently developed techniques which work. They may not work as well as we would like, and future research will surely improve the techniques; but, for now, the man who must for the first time machine titanium will be able to use them as a base from which to launch his efforts.

The various titanium alloys share some unique characteristics which cause machining difficulties. Titanium has a marked affinity for many of the elements found in common tool materials, and will combine with them at temperatures often generated at cutting tool edges. The consequent loading or welding leads to seizure and breakage in addition to producing a poor surface finish. It is therefore well when using carbide to stick to the "straight" tungsten carbides, rather than the heavily blended types, and particularly to avoid titanium carbides.

Another irritating titanium tendency is its chip-forming peculiarity. Whereas steel chips will be considerably thicker than the feed, titanium chips are long and thin and only slightly thicker than the feed. They also curl quickly away from the tool tip, and the resultant small tool chip contact area is hardly conducive to heat dissipation. And hot titanium chips become plastic enough to clog flutes. The tool

In this experimental operation Pratt & Whitney's Cutting Tool Research Laboratory uses a ceramic tool tip to turn titanium (Rem-Cru A70). Speeds varied from 600 to 1000 sfpm. Depth of cut was .125" and feed was .016 ipr.



End milling titanium (Rem-Cru A70) is accomplished by Pratt & Whitney's laboratory with a precision recording wattmeter. Depth of cut here is ⅛". Feed: .017". Speed: 50 sfpm.

designer should therefore concentrate on designs which encourage a wide tool-chip contact area.

It should go without saying that tool sharpness and fine grinding finish are mandatory for optimum performance. But how to select the tool material? This is tricky to discuss in generalities, because so many individual job considerations influence the decision. Carbides work well in steady cuts, but in interrupted cuts are far more susceptible to chipping than is high speed steel. With high speed, best results may be expected from tools of high cobalt content. Some of the cast alloys are well suited to milling cuts.

In machining with carbides, temperature will rise rapidly as speed is increased, and the apparent solution is to use slow speed and heavy feed. The problem is not so acute with high speed steels, but here again heavy feeds do well. One explanation which has been widely offered stems from the belief that titanium has a great tendency to work-harden during machining. By using heavy feed the tool keeps under the work-hardened layer and avoids dulling and temperature rise. In confutation of this theory, however, are the findings of the Production Research Association of Great Britain, who discovered little evidence of work-hardening during exhaustive drilling tests.

A note of caution before proceeding. Finely dispersed titanium dust or chips are easily ignited, and the same precautions should be taken as are taken with magnesium. Now let's turn to some of the common types of machining and the techniques so far employed with a measure of success.

Turning Titanium

For turning titanium, use a sturdy, rigid lathe, one which can be trusted to maintain constant speed and feed during the cut.

Because of titanium's above-mentioned chip-forming characteristics, turning tools should have a large nose radius about twice that used for steel. However, it is often necessary to use a small radius of about 1/32" to prevent chatter.

Carbides, cast alloys, and high speed steels may all be used, with a heavy flow of water-base soluble oil.

For scale removal from rough billets or forgings, using carbide, the nose radius should be kept fully beneath the scale. At depths of cut up to ¼", try 50 to 60 sfpm, at .010 to .015 ipr feed. In roughing cuts after scale removal, speed may be increased to 150 sfpm at .015 to .020 ipr feed. For light finish turning, shallow depths at light feeds, speed may be increased to 300 sfpm, and the nose radius need not be large.

Varying the rake angles either side of 0° will influence performance, but as a start try 5° side rake with no back rake. Side and end clearance angles 6° to 8°, side cutting edge angle 30°, end cutting edge angle 5°. Tool overhang must be held to a minimum.

In the cutting tool research laboratory of Pratt & Whitney Company, Inc., manufacturers of precision machine tools, cutting tools and gages, titanium has been successfully turned at 600 sfpm with ⅛" depth of cut, .016 ipr feed, using ceramic tool tips, 7° negative back and side rake, 1/16" nose radius, 7° clearance angles. This was done dry, but a spray of coolant was applied to the chips to prevent accumulation of excessive heat.

Milling Titanium

The main problem in milling titanium is chipping of cutter teeth. Each tooth takes its individual titanium chip which may weld to the tooth, and remain there as the tooth emerges from the cut. When the tooth next enters the cut, the chip must be knocked off before clean cutting can again take place. If the presence of this welded chip causes sufficient contact pressure, the tooth will chip. This condition may be largely overcome by climb milling, in which case the chip is of maximum thickness at the beginning of the cut and the tooth emerges with the thinnest possible welded chip.

Both carbides and cast alloys seem to stand up as well as high speed steel in steady cuts and, of course, permit higher speeds than high speed steel. Radial rake angles of 5° to 20° negative are generally desirable. The critical design feature is primary clearance. This must be small enough to give good support to the cutting edge, but large enough to avoid rubbing. Thus a compromise is needed, and 10° to 15° may be best.

In face milling, a wide 45° corner angle serves to elongate the cutting edge, thin the chip for any given feed, and spread out cutting pressure and heat generation.

Feed rates of .003 to .008 ipt are practical, with cutting speeds of perhaps 30 sfpm with high speed steel, 50 sfpm with cast alloys, and as high as 200 sfpm with carbides.

In all types of milling cuts in titanium, it is important not to allow the tool to dwell, but to maintain a steady power feed throughout.

If wall thicknesses of 1/16" or greater are maintained, and the work has been properly held, stress relieving subsequent to machining should not be necessary in order to hold reasonable dimensional stability.

Drilling Titanium

In order to give the drill every advantage, use the stubbiest drill possible for the depth of hole to be drilled. Drills should also be supported as rigidly as possible. Inconsistent with this need for rigid support and stubby length, however, is the need for greater than normal clearance between drill bushing and workpiece, in order to accommodate the long curly drill chips for which titanium is notorious.

Flutes should be highly polished, or even bright chrome-plated, with helix angles of 30° to 35°. Margin width should be narrow, in order to minimize the tendency to pick up titanium or to bind in the hole as the drill expands faster from heat than does the titanium.

High speed steel drills of high cobalt content may be run at speeds of 30 to 50 sfpm, at feeds of .002 to .004 ipr for diameters under ¼", and .004 to .010 ipr for larger diameters. Whether or not work-hardening occurs, it is well to have each lip maintain a substantial chip load. If a feed of less than .0005 ipr is used, or if feed is not held steady, there is risk of intermittent rubbing and rapid drill failure. This failure will be preceded by persistent screeching and heavy smoke or vapor caused by subjection of the coolant to excessive heat.

From reading the above speeds and feeds, it might be assumed that drilling titanium is little different from drilling steels. But drill life will be considerably shorter.

If a standard drill is cut down to make it shorter, the web should then be thinned. In grinding the point, try 130° included angle with 11° to 13° lip clearance.

In deep drilling, retract the drill at intervals as necessary to clear chips from the flutes. The drill will take its worst punishment as it breaks through the work. Therefore, in designs which permit, avoid drilling through the piece.

Both water-soluble compounds and sulphurized and chlorinated oils have been used with success.

Reaming Titanium

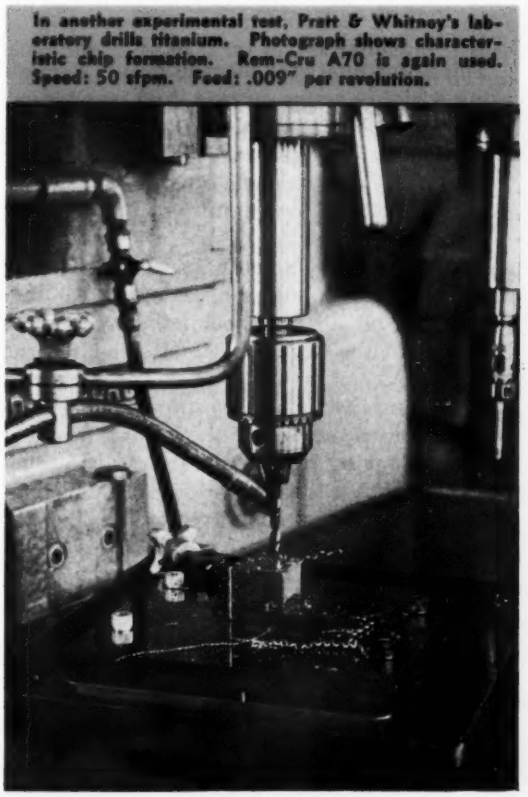
Best reaming conditions call for a setup similar to that which is best for drilling; i.e., stubby reamers rigidly supported. For best surface finish in the hole, use spiral-fluted reamers at low speeds (10 to 15 sfpm) and substantial feeds (.008 to .016 ipr). Expect a small degree of close-in, following extraction of the reamer. For a coolant, use a generous flow of heavy sulphur-base oil.

Tapping Titanium

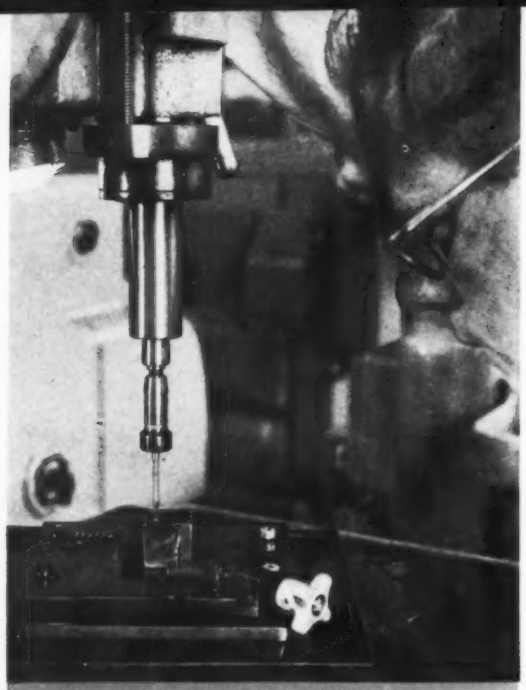
Tapping is a problem, and will remain one so long as the stringencies of aircraft design demand, as they often do, close thread tolerances, heavy percentage of full thread depth, and bottoming holes. Taps operate under some distinct disadvantages. Although speed can be varied, feed cannot — being governed by the lead. Also, working in enclosed quarters, chip disposal and coolant supply are problems.

All who have tapped titanium advise against tapping any but through-holes. This is smart advice, but comforts not the man in the shop who **must** tap bottoming holes.

Here is a synopsis of what can happen while tapping:



In another experimental test, Pratt & Whitney's laboratory drills titanium. Photograph shows characteristic chip formation. Rem-Cru A70 is again used. Speed: 50 sfpm. Feed: .009" per revolution.



Pratt & Whitney's Cutting Tool Research Laboratory uses a torque dynamometer when tapping titanium (Rem-Cru A70). Speed of tap is 40 sfpm. The short thread body (5 full threads beyond chamfer) can be seen.

1. As the tap begins cutting, heat is generated.
2. The tap absorbs the heat and expands.
3. The titanium also absorbs heat but expands very little, owing to its low coefficient of expansion.
4. The tap binds.

This unfortunate sequence of events suggests using a highly active cutting fluid, applied copiously. Carbon tetrachloride works best, but is noxious and therefore usually impractical. Sulphurized and chlorinated oils work well, superior to water-base emulsions.

Two features of tap design can be used to combat binding. One is to grind the tap with double or triple standard back taper. Another is to grind off all teeth behind the fourth or fifth full tooth (which in effect, produces the ultimate in back taper.)

In tapping through-holes, spiral-pointed taps are best, since they drive the chips ahead and prevent clogging the flutes. In any hole, it is advisable to use the largest size tap drill permitted, thus holding metal removal by the tap to a minimum.

In the machine screw sizes, 2-flute taps are desirable, since they have a large core diameter. For sizes ¼" dia and larger, 3 or more flutes may be used. Hook angle in the spiral point may be 13° to 18°. A 4-thread chamfer length is a good starting point, with 5° to 7° effective chamfer relief. Try cutting speeds in the range 20 to 40 sfpm.

Various designs have been tested to combat loading or galling as well as heat from friction. On taps having no thread relief, it is common to grind an axial v-shaped groove down the middle of each land, as deep as the root of the thread, and approximately one-third the width of the land. A similar reduction in the area of contact between tap thread flanks and the titanium workpiece may be achieved by grinding a bevel along the heel of each land, but this may cause wedging of the chips when the tap is reversed.

More effective than these modifications, at least in sizes larger than perhaps No. 8, is the use of full eccentric or con-eccentric thread relief. In theory, at least, if a tap had full eccentric relief and heavy back taper, the only portion of the tap in contact with the titanium would be the cutting faces of the chamfered teeth and the first full tooth.

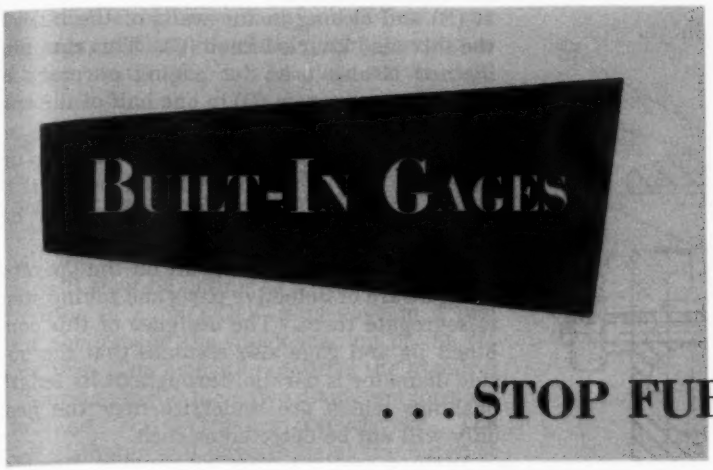
Another design feature which has been almost universally recommended is one which should rarely be necessary or helpful. That is an interrupted thread, in which every other tooth is removed from the tap. Here again the apparent aim is to reduce the contact area between tap and titanium. Such a recommendation has understandable merit for taper pipe taps. But for straight threads, the tap's back taper should obviate the need for interrupted threads. If such a design is attempted, bear in mind that it can only be done with a tap having an odd number of flutes, and that all teeth should be left in the chamfered section.

In bottoming holes, do not use the spiral point and 4-thread chamfer. In many cases the job must be done by using a tap with a plug chamfer followed by a tap with bottoming chamfer, perhaps even using the latter by hand. Serial taps offer another possibility. In any event, extreme bottoming holes in titanium are troublesome and must be worried through.

Various surface treatments have been tried; and, in the absence of thorough testing, conclusions are indefinite, although it is likely that a hard surface skin and vapor blasting will increase tap life.

Conclusion

Many of the foregoing suggestions sound like old stuff. They are. Such advice, for example, as having minimum turning-tool overhang and keeping tools sharp—that's good advice for cutting any material, not just titanium alloys. They are reiterated here solely to emphasize the fact that basic cutting tool design and application are the best background for anyone scheming to make titanium chips. end



. . . STOP FURTHER WASTE

by Clifford T. Bower
London, England

MOST JIGS AND FIXTURES can be made to reject parts which will not enter the work locations, and thus they can provide automatic gaging which is usually in only one tolerance direction. For instance, a male location will not engage with an undersize female part and, conversely, an oversize male part will not engage with a female location.

To make tools which will reject parts that are either over or under the tolerance permitted calls for additional complication of construction which may impede the easy loading of the part. Therefore, the attractions of combining limit gages with jigs and fixtures should be weighed very carefully before adopting them.

It may be that the separate application of a standard plug limit gage to the part will be a quicker operation in the long run than that of using the gages incorporated into the tool. The advocates of the system of building limit gages into jigs are, in effect, asking the machine operator to inspect the work of the previous operator.

It might be a simpler solution to the problem to provide each operator with standard gages for inspecting the parts before loading them into the jigs. Such a proposal may be psychologically impossible to apply owing to restrictive labor practices or attitudes.

Gages built into production tools can be, sometimes, a good means of reducing inspection costs without labor troubles, since technical subterfuge of this nature reduces labor in an obscure manner not readily recognized by the average operator.

It would be a fairly simple matter to design a tool with a crop of dial gages for indicating that various parts of the workpiece are within the tolerance range permitted. Unfortunately, such indicators would be a source of trouble if fitted to, say, a rollover drill jig. The arduous work done by such jigs is not conducive to efficient maintenance of accuracy, and the dial gages would be quickly deranged or their settings altered so that they would give false readings.

What is needed in a built-in gage is robust construction which will resist a certain amount of abuse without derangement. When possible, the gage should show in some positive manner that the part dimension is outside the permitted tolerance range. The following descriptions of some built-in gaging methods will indicate lines of action for tool designers to consider and adapt to their conditions.

The editors wish to point out that the fixtures Mr. Bower has shown are hypothetical, and that they were simplified for clarity.

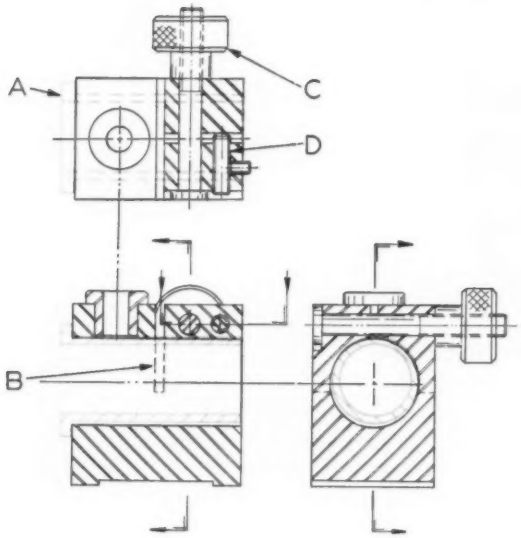


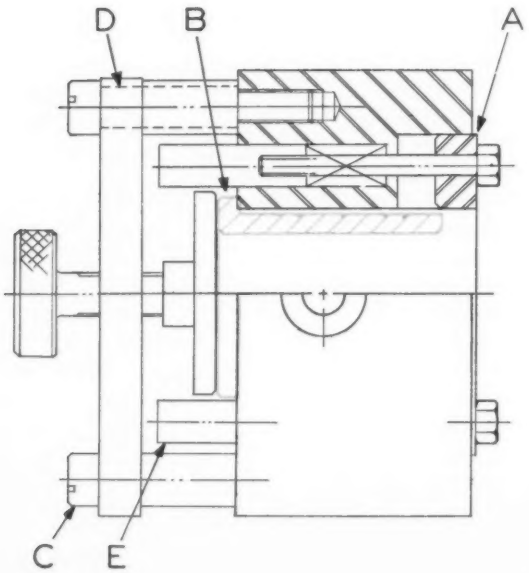
FIGURE 1

Outside Diameter Gaging

In Figure 1 is shown a simple pot-type jig used for drilling one hole through the wall of a bearing bushing (A). The outside diameter of the bushing is to be a press fit when assembled later. Therefore, the outside diameter must be held to a close tolerance. The maximum diameter of the bushing is gaged by the hole in the jig; if the bushing is oversize, it will not enter the jig which acts as the "Go" ring gage.

Provision of a "No Go" ring gage is accomplished as follows: The part is clamped in the jig by splitting the jig for about half its length at (B) and closing in the walls of the hole by the threaded knurled knob (C). This clamping method is also used for gaging purposes by placing a stop-screw (D) in one half of the split portion so that the amount of gap closure can be limited. Stop screw (D) is set so that an undersize part will not be clamped but will be rotatable in the jig after the clamp nut has been tightened.

FIGURE 2



Use of this jig is dependent on the operator being aware of defective parts and taking steps to segregate them. The designer of this combined jig and gage also assumes that the outside diameter is parallel throughout its length; bushings which are undersize near the head only will **not** be detected as such.

Another method of work outside diameter gaging is shown in Figure 2. It entails incorporating the "No Go" ring gage (A) in the jig, a part-section plan view of which is illustrated. This is a pot jig for drilling a large head bushing, and the clamping acts axially on the head (B) of the bushing. The clamp comprises a flat bar swinging about the pin (C) with a slot at its other end for latching on to pin (D). Axial pressure is applied to clamp the part by means of the screw and pad.

An oversize workpiece will not enter the bore of the jig. An undersize part will enter and can be pushed axially for the full length of the jig bore and can pass through the ring gage (A) at the far end of the bore. An undersize unacceptable workpiece will not push (A) to the right, and rods (E) will not be retracted to allow clamp bar to swing into position, for clamping the part.

A part whose outside diameter is within the tolerance band would be accepted by the jig as shown in Figure 2.

Compression springs for returning the ring gage to the operative position, prior to reloading the jig, must be as light as possible so that a minimum amount of effort is expended by the operator during the loading operation.

A smaller pot jig incorporating a sliding "No Go" ring gage is shown in Figure 3. The ring gage is (A) and is provided with a pair of rod-shaped plungers, having springs, for pulling the ring against the jig body when it is empty. Only the rear part of the jig is shown in Figure 3, as the clamping means can be of any standard type. The ring gage carries at its upper surface a flat piece of steel (B) to form a sliding shutter over the drill guide bushing (C).

A part whose outside diameter is too small will pass through the ring gage without moving it axially; the shutter will thus block the entrance to the drill guide bushing and the drill cannot be passed through. A part which

is within the tolerance band will not enter the ring gage, pushing it axially during loading so that the shutter (B) is slid clear of the drill guide bushing.

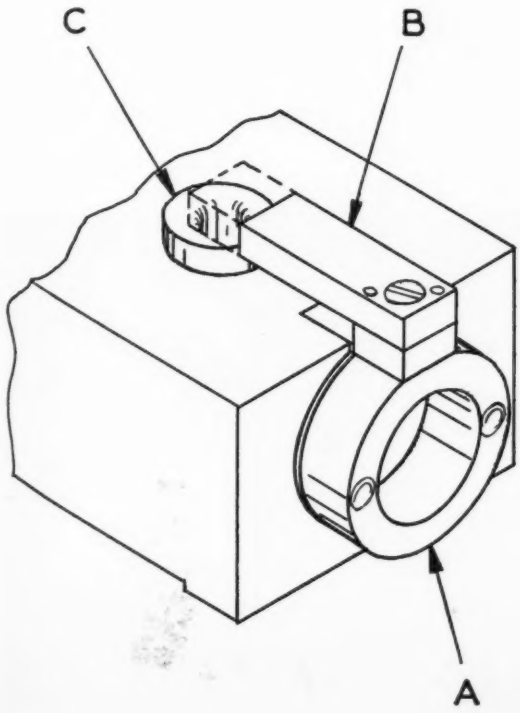
Bore Gaging

A common means for locating bored work in jigs and fixtures is to mount them on a spigot or mandrel. If the bore in the work is too small, the mandrel will not accept it. The mandrel will then be acting as a "GO" plug gage. Provision of a "NO GO" plug gage in a tool need not impede the quick loading of the jig or fixture. The principle requires the mandrel or locating plug to have two diameters forming "Go" and "No Go" gages respectively. The "Go" diameter will have to be at the outer or loading end of the mandrel to detect and stop undersize bores. Oversize bores will be detected by the "No Go" diameter located farther along the plug.

One way of using the locating plug as a limit gage is illustrated in Figure 4, which shows application of the principle to the gaging of bores in spur gears before the teeth are cut on a Fellows type machine.

Figure 4 shows an acceptable gear (A) in position in the gear cutting fixture. The central mandrel has the "No Go" diameter at (B), and the "Go" diameter (C) at its upper end. A plate (D) surmounts the gear blank, and pressure is applied to it by means of the C-washer. The mandrel is screwed downward for clamping.

FIGURE 3



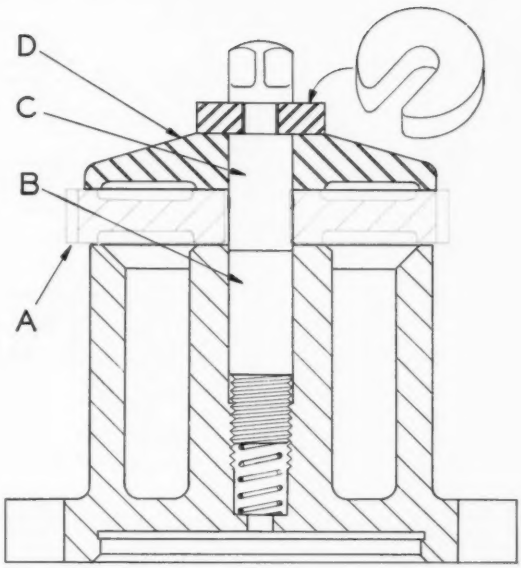


FIGURE 4

In loading an acceptable component, the mandrel is disengaged from the thread in the fixture and is supported by the compression spring well clear of the internal thread. The gear blank is placed on the mandrel and its acceptable bore will not pass the step denoting the junction of the two sizes. In order to engage the clamping threads with one another, the operator will have to press down the gear on the mandrel.

If a gear with an oversize bore is offered to the mandrel, it will drop down until it rests on the top supporting surface of the fixture body. The mandrel cannot then be pushed down by means of the gear for engaging the threads. The mandrel could still be pushed down by applying pressure to its upper end, but this would not be so convenient to the operator as pushing on the broad flat surface of the gear blank. The extra inconvenience of pushing down the mandrel by its small top is sufficient inducement for him to reject the gear blank.

If automatic safeguards against defective parts cannot be applied to the gaging means in the jig or fixture, carefully designed annoyances for the operator will often call attention to the fact that defective parts are in his hands.

end

STEPPED ALUMINUM EXTRUSIONS . . . PRESENT AND FUTURE

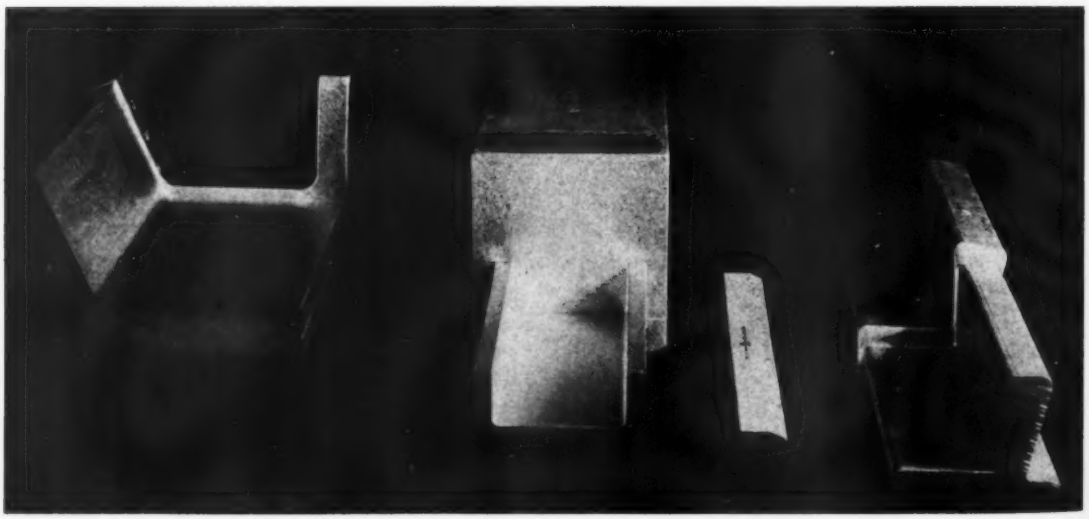
THE MOST SIGNIFICANT stepped aluminum extrusion process, which has recently come into prominence, was discussed in a panel presentation by C. J. Huffman, technical superintendent, Halethorpe Works, Kaiser Aluminum & Chemical Corporation, before the October session of the Aircraft Production Forum, Society of Automotive Engineers in Los Angeles.

Many developments have been made throughout the years to modify the extrusion process and the basic equipment. New and more difficult tasks are being demanded daily of this highly flexible tool. Industry has played an important part in the advancement of extrusion technology through its demands for more complex sections, closer tolerances, and new materials. Typical of the extruded products resulting from aircraft industry demands is the stepped extrusion, Figure 1.

Initially these efforts were spurred on to overcome the volume and weight limitations of existing equipment. Placing material where it is required along the extruded length makes it possible to design integral connecting lugs and obtain the longer lengths required. Aircraft designers quickly took advantage of the simplified design possibilities with stepped extrusions. Economic advantages became evident with reduced raw material costs and decreased machining requirements.

A variety of methods have been devised to produce extrusions with variable cross sections throughout the length. Early patent literature describes the use of tapered or stepped mandrels used to produce tapered hollow extrusions which were split longitudinally to produce relatively simple sections. Extrusion dies with externally operated movable segments have been described in great detail to

FIGURE 1



produce tapered and stepped parts. These were the fore-runners of the step extrusion processes which are in common usage today.

As reported by Mr. Huffman, step extrusions are commonly produced at the present time utilizing two sets of extrusion dies. The small or minor section is extruded first to the desired length at which point the extrusion cycle is interrupted long enough to change dies to produce the major configuration. In most cases the dies are comprised of two segments to facilitate removal of the dies from the extruded part. Figure 2 represents a schematic tooling arrangement and operational sequence for this method of producing stepped extrusions.

A modification of this process is allowed through improved press designs utilizing a secondary locking arrangement to hold the minor section dies in position, Figure 3. If single piece dies are used, the minor must be stripped off the end of the extruded section with the major die being threaded over the end of the minor part.

In working from the finished machined part to the stepped extrusion requirements, dimensional tolerances are of prime importance to insure ability to manufacture the desired part yet avoid an excess of stock. Stepped extrusion tolerances have not been standardized throughout the industry at present; however, the following comments indicate those that can be obtained today. These differ primarily from normal extrusion tolerances in straightness and step area dimensions. The straightness of the overall part is measured by deviation from a reference line, with the junction area (8″ on either side of the step) being excluded.

The straightness of minor and major positions of the extrusion is determined individually, with the junction area being excluded. The minor and major positions are usually furnished to standard extrusion straightness tolerances.

Due to the change of flow conditions in extruding the major and minor sections, the junction area usually presents the greatest straightening problems.

In the design of stepped extrusions, produced from split dies, parting line locations should be considered not only from the tolerance standpoint, but from the ability to remove tools from the section. In some cases it may be necessary to provide slight draft angles on extended elements to accomplish this. While the major and minor sections may frequently have a common plane, this is not a requirement of the process. In all cases the major section must completely enclose the minor.

STEP EXTRUSION PROCESS

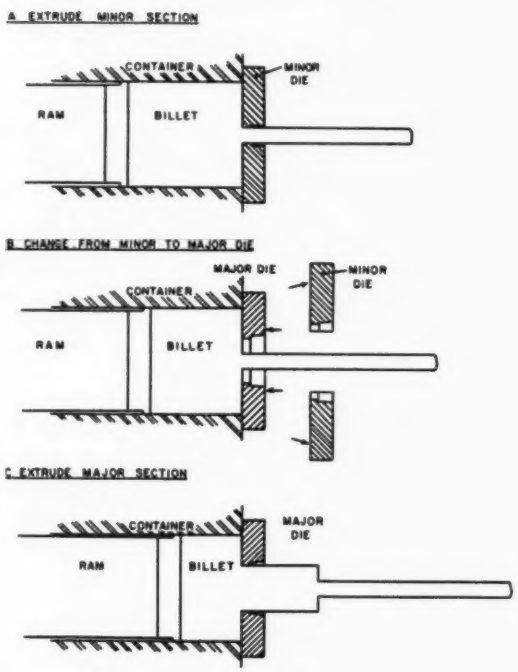
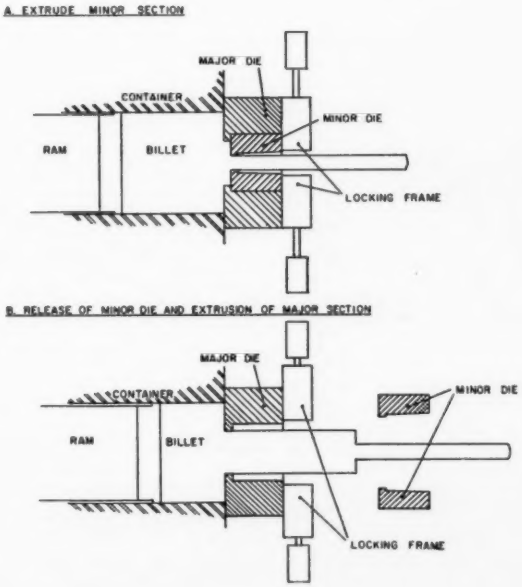


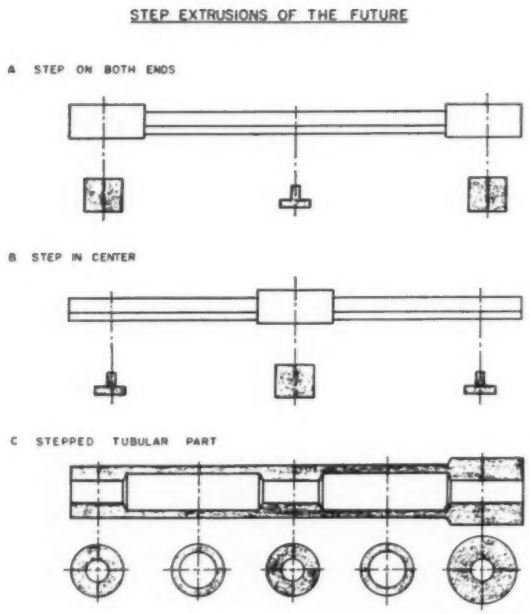
FIGURE 2

Cross sectional tolerances of stepped extrusions are usually greater than normal due to the inherent instability of split dies. It is generally necessary to provide sufficient machining stock on all surfaces of the section to be able to obtain the required accuracy of dimension and surface finish requirements. This is

FIGURE 3

STEP EXTRUSION PROCESS USING SECONDARY LOCKING FRAME





particularly true regarding dimensions which fall across the parting lines of the die. An additional tolerance is usually required on these dimensions due to the possible shifting of the die segments.

Many applications for large tubular parts are being developed in the missile field. Internal and external steps on these tubes can be obtained through the use of a stepped mandrel combined with the techniques normally used to produce step extrusions. The use of a stepped mandrel has previously had the limitations of allowing only unidirectional stepping of the interior surface. With modern extrusion equipment it is possible to place these steps at either end of the tube or in the center, as desired. Typical of a product that could be produced by this means is the part shown in Figure 4C.

end

FIGURE 4

Grinding Roller Bearings to Three Micron Tolerance

Automatic control instruments for industrial machine and process operations are most important in the fast growing trend toward the automated factory.

An example of control instrument application is found in a test run in which a grinder was equipped with Atcotran components for grinding to three micron tolerances.

The problem was to reduce the area of dispersion around established tolerances in the semi-automatic grinding of roller bearings. In addition, to keep the operation automatic, improve product quality, maintain or increase output, and reduce percentage of raw material and finished product rejects.

The first four steps of the operating procedure remained the same as in the previously used electro-mechanical limit switch system, where they were:

1. Hand load two rough ground spherical rollers.
2. Engage clutch and start infeed manually.
3. Continue rapid manual infeed until sparking occurs.
4. Release hand feed.

At this point the procedure changes:

5. Automatic feed takes over. Atcotran differential transformer-measuring head with electrical transmission and control continuously senses amount of stock removed from workpiece during the grinding operation and stops feed at a few microns above the established grinding dimension. It simultaneously starts timed dress-up. Automatic cutoff at end of dress-up actuates withdrawal and stops spindle motor.
6. Operator manually actuates parts release lever and finished parts drop into box.

The results obtained indicated that the problem was solved and the ATC system was accepted as the simplest and the one presenting the least number of complications with the ability to be enlarged upon for future additions or refinements. Temperature and humidity have little effect on the accuracy of the unit. The ability to transmit the measuring head signal from the workpiece area to a remote control relay made possible repeat accuracies in the neighborhood of five microns.

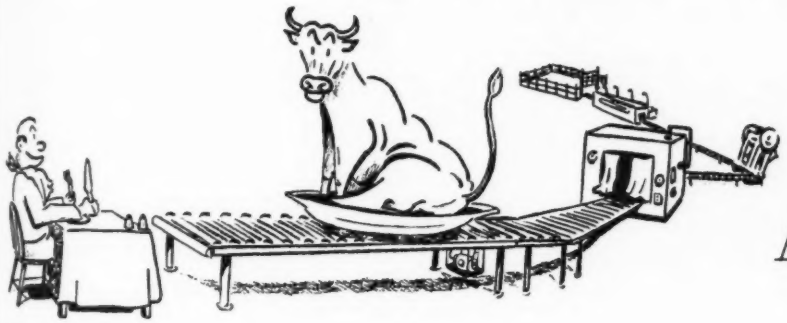
The actual results obtained were: (1) production was increased; (2) a reduction in size classes was realized; and (3) a reduction of the area of dispersion and a resultant reduction of rejects to a fraction of 1%.

The ATC components used were products of Automatic Temperature Control Company, Inc., 5212 Pulaski Ave., Philadelphia 44, and included: a zero adjust assembly; electronic switch; and a motion transmitter.

Coming Soon:

"How You Can Save With Tubular Stampings"
"Air Tool User's Notebook"
"Fast Automatic Welding Builds Auto Frames"
"Plastic Facing Lowers Costs of Drop Hammer Dies"

THE SMALL MANUFACTURER'S STAKE IN AUTOMATION



by Chester Linsky
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AUTOMATION has become a subject of widespread interest as a result of extensive publicizing through newspapers, domestic and trade magazines, radio and television. The word has such dollar-studded appeal that we are being besieged by all sorts of advertising of automation in the office, kitchen, banks, communications systems and mining.

While it is true that in the sense of what is popularly construed as automation, these applications could be justifiably classified as such, they are not, however, generally acceptable in any practical analysis of the subject. Moreover, where automation is discussed from the manufacturing angle, the public has erroneously gathered that automation means rigid adherence to high volume, mass production transfer type machinery, keyed together in a long line under the sole control of a "pushbutton" artist.

This has become an unfortunate impression, one which big industry would like to kill. It is far from typical. Not only are these types of systems expensive, highly specialized, and quite inflexible, but they are limited to manufacturers with ample tooling budgets and tremendous sales of rigidly limited product lines. Oddly enough, these lines are still not completely automated inasmuch as they must be manned.

What is commonly construed to mean automation is, in reality, mechanization. Mechanization means transfer of skill and effort from man to machines; whereas automation implies the transfer of thinking or "sensing." This is accomplished by incorporation of servo mechanisms which feed information back into a master control which maintains a constant correction over the process in order to maintain production within predetermined dimensional or quality limits. Theoretically, no humans should be required if the feedback system is operating properly. Big industry still finds it necessary to rely on "human controls" to prevent jam-ups on the production line and damage to expensive equipment which cannot yet be adequately or economically controlled by mechanical, electrical, pneumatic or hydraulic controls alone.

It should be recognized that the greater percent of automation activity taking place in American industry today concerns relatively small operations. It includes redesign of parts, processes and equipment to utilize standard catalog items with existing plant facilities in order to effect a high degree of automation at a fraction of the cost of specially designed equipment for the same end result. Speaking of specially designed equipment, machinery and tooling, some machine tool builders or automation equipment manufacturers prefer to incorporate standard catalog items rather than take on the problem of designing tailor-made installations for a customer's production line.

While automation is commonly associated with larger manufacturing plants, many smaller manufacturers have tried automating their production with excellent results. But the steps taken by small industry in general have been comparatively limited in scope.

One probable reason is that top management in smaller companies believes large capital outlays are required. This need not be the case. There are several excellent methods by which the benefits of automation can be realized. They involve extensive evaluation of product design and manufacturing techniques for the purpose of sharpening up on products to make them more compatible with economical manufacturing methods, and the incorporation of standard catalog items with existing manufacturing equipment to effect an inexpensive but highly productive process.

Small and medium sized plants must get into automated production if they hope to survive the competitive pinch of larger, better tooled and managed plants. Small industry within itself is terrifically competitive, with price cutting as a too frequent means of making bare expenses in order to stay in business. Therefore, the small company that can cut its production costs through automation will be the company to survive. Many small novelty manufacturers are likewise feeling the pressure of competition from foreign manufacturers. While American industry on the whole is considerably ahead of foreign competitors in manufacturing know-how, we are finding it increasingly difficult to compete against low cost foreign labor. Automation, in many cases is the only means of survival. There are, of course, many other advantages of automation for the small manufacturer which should be considered.

I said that automation can be achieved on a limited budget. By limited, I really mean "peanuts." Let's look at some of the more typical pieces of equipment used for automation. They include air cylinders for opening and closing fixtures and other workholding devices, for parts positioning and ejection; parts feeders for automatic feeding and indexing an unlimited variety of parts for fabrication and assembly purposes, inspection and sizing; automatic workhandling devices, such as turn-

tables, dial indexes, turnover fixtures; transfer devices to move parts in process from one operation to another; small conveyors of all sizes and shapes; weighing and sorting equipment; drill press and other machine tool feeds to accurately feed cutting tools into parts at pre-determined rates; limit switches and other control devices to actuate, sense, time, and control a variety of operations sequentially or in any order and rate desired; assembly machinery, flexible for a variety of small operations and multiple setups where fastening, drilling, tapping, reaming, staking, assembling and a variety of other possible operations must be performed at one time; automatic multiple spindle drill heads for single station multiple processing applications; and the newer in-line automatic assembly machines.

There are many more types of equipment in use, but these are generally considered the meat of what a small manufacturer needs to convert from hand operated to machine controlled process and assembly operations. Measured in terms of dollars and cents, it is possible to automate a piece of existing equipment for high volume production for as little as $250 and at the same time eliminate the need for an operator. For an additional $100 it is also possible to add feedback characteristics to this system and make the unit completely self-contained.

Where transfer between machines is desired, by adding air feed devices, simple belt conveyors or chutes, parts feeders, air clamps and ejectors, timing devices and limit switches, many a small manufacturer has been able to highly automate his production, get more consistent output, reduce scrap, improve quality and cut out several machines previously required — all for as little as $2500. In this respect, part of the cost is tied up in the design and construction of jigs and fixtures and other small tools which usually have to be built for non-automated production, anyway. One good feature of this type of approach is that the plant can build and assemble its own equipment in the tool room without dependence upon outside fabricators.

This equipment is so inexpensive that it frequently pays to discard it when it starts to wear out. Furthermore, it has become so well standardized that replacement parts are readily available, requiring limited inventories of repair and replacement parts for most applications. Maintenance and installation are simple—an added savings when one considers the big problem larger manufacturers are having training technicians for maintenance work. Most maintenance men need only limited instructions and wiring diagrams for such items as simple control devices and hydraulic systems.

Ordinarily, any salesman will be happy to detail the proper setup for his equipment on plant machinery and will usually work with a manufacturer's mechanics to show them how to install and maintain it. In terms of labor savings alone, this type of automation could easily pay its way in a couple of months. Add in the savings from reduced scrap, increased output and improved customer relations, and the equipment pays for itself even faster.

Another important feature of automated production for the small manufacturer is the savings in in-process inventories. Instead of banking parts between various operations, automated production permits feeding in-process parts directly to the next machine or operation without an intermediate parts bank. This permits reducing inventories to a bare minimum (commensurate with proper banks to take care of possible emergencies as they may arise). Failure of one critical piece of equipment, however, does not mean that the rest of the line must go down. Instead, production is maintained while simple repairs are made on the equipment which went down. The beauty of low cost automation is in its ease of maintenance. Compared with highly specialized equipment, maintenance can be accomplished in a matter of minutes. It is further facilitated by the fact that most manufacturers of such standard components emphasize rugged designs which permit their equipment to take a beating.

Probably one of the biggest advantages of this type of automation is its flexibility. Standard equipment is, in itself, inherently flexible. When one order runs out, simple setup places the equipment ready for production on a different product. Many of the newer pieces of equipment have been designed to permit almost instantaneous changeover. This is particularly true of tape controlled machine tools. While these tools may have a higher first cost, they are so extremely flexible that changeover to an entirely different operational sequence can be accomplished in minutes. This system has also opened up completely new methods of dimensioning. Low salaried clerks with the use of special typewriters merely punch out dimensions on tapes. The tapes are then fed or "programmed" into the machine tool and the prescribed process is automatically followed. Short runs, even individual parts setups are profitable with this type of equipment. As for savings, the potential is unlimited.

To illustrate how small scale automation can be applied to a typical operation, consider the manufacture of brass door hinges. These hinges are made up from three basic parts—two hinge plates (one right and one left, to permit interlocking) and a pin. While there are several possible methods of producing each part, assume they were made as follows: The hinges were sheared to length on a press; staked in boxes and moved to another press where the edge was rolled, and then moved to a drill press where three holes were drilled and countersunk. Since the hinge plates are different, separate runs may have to be made on the intermediate notching (and possibly forming) operation.

The pin is made of wire, cut to length and carried to an assembly fixture where an operator assembles the three parts on a hand operated arbor press.

This operation could have required three small sheet metal presses, a drill press and arbor press along with five operators. Add the problem of packaging, requiring an additional operator to count out and insert six screws and the collapsed hinge assembly into an envelope which must then be sealed, and you can see how expensive this process could be.

Automating the fabrication and assembly is a relatively simple process. The hinge plate stock could be ordered in coils of proper width. The coils could be mounted on roll feeds which would automatically feed into two existing presses, one for rights and one for lefts. These presses could be set up for two-station operation. The strip is fed into the shear station where it is notched and sheared. With each return stroke of the punch, the cut-off section is fed along a track into the second die where the edges are rolled. This phase of the process requires in addition to the existing presses: two inexpensive coil feeders and a carrier mechanism to move the cut-off section along the track into the second die.

As parts are fed into the second die, they automatically push the last part ahead where they are taken by another carrier mechanism and fed into an air-operated clamping fixture which operates from a limit switch actuated by the part as it enters the fixture. As soon as the fixture clamps the part, a second limit switch actuates an air feed arm which rapidly advances a multiple spindle drill head for automatic drilling and countersinking the mounting holes in the plates. On the upward stroke of the spindle another limit switch causes the fixture to open, with the entering plate pushing the last plate out and down a chute into a storage bin. Depending upon quality requirements, if the parts have to be tumbled they can be fed to barrel finishers having an automatically timed cycle.

The pin is prepared by shearing it to length in a similar manner as the plates, but on an inexpensive wire

. . . Continued on Page 141

A SCIENTIFIC MANAGEMENT ARTICLE

The Principles of INVENTORY MANAGEMENT *that Lead to Higher Profits*

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ALTHOUGH THERE ARE A NUMBER OF TREATISES on the subject of inventory management, most of them approach the subject from the standpoint of procedural requirements. The importance of systems in the control of inventory cannot be denied.

The system defines the framework within which the operation will function properly. The system establishes the overall perspective of the operation and sets up a series of controls. Within this framework, however, are additional opportunities for cost savings which should not be disregarded. This situation is particularly true of inventory.

The distinction between the system for controlling inventory and the economic aspects of analysis within the framework are not usually made clear in the standard text. For our purposes, we will place the system under the heading of "Inventory Control". The economic analysis, within the framework, will be termed "Inventory Management".

The field of inventory management may be grouped into two major areas:

1. Order quantity analysis, and
2. Reorder Point Control, or its correlative, safety allowance analysis.

Safety allowances are frequently referred to by such terms as "cushion", "reserve component" or "protective stock". The meanings are essentially the same, for they refer to that part of the inventory which is carried in excess of usage as protection against stock-outs.

Just as methods improvements will frequently produce slight changes in the design of a product, so too will modern inventory management bring about minor changes in the system. For one thing, it will provide more precise controls over ordering functions and the quantity of protective stocks. It will also introduce controls into a system where such controls were previously lacking.

Because the techniques are comparatively new and because they are fundamentally statistico-mathematical in nature, the field of inventory management has been assimilated into the general field of Operations Research. However, historical search shows that almost all of the modern developments were initiated many years ago by such firms as the Bell Telephone Labs and many others. In fact, even the application of the techniques predate the name "Operations Research" by many years.

Much of the background employed in the development of the theory involves many of the deepest and most theoretical concepts of mathematics. Because of its abstruse underpinnings, works written on the subject tend to be tedious and complex, giving the appearance of unreality or impracticability to any but the most persistent souls. The shop manager has difficulty visualizing the symbolic, non-descriptive approach of the mathematician and overlooks one of the really fruitful developments of recent years.

These concepts are here presented in an immediately usable form, requiring a minimum of mathematical formulation. None of the formulas involves more than a knowledge of High School algebra. They involve only the very elementary parts of High School algebra — namely, substituting letters for numbers. The letter "P", for example, is used in Formula 1 to stand for "Procurement Costs" because procurement costs will vary with each product and each company. Use of letters thus enables the presentation to be general and reduces the possibility of confusion and misunderstanding. Numerical examples are also included

Should a one-month or a two-month supply of Product X be carried in stock? Can the same controls be applied to in-process inventory? The answers can mean tremendous savings to your company; lack of these answers may mean crippling losses. The principles discussed by Mr. Reinfeld are of vital importance in purchasing, production and materials control, distribution, and other diverse areas.

— The Editors

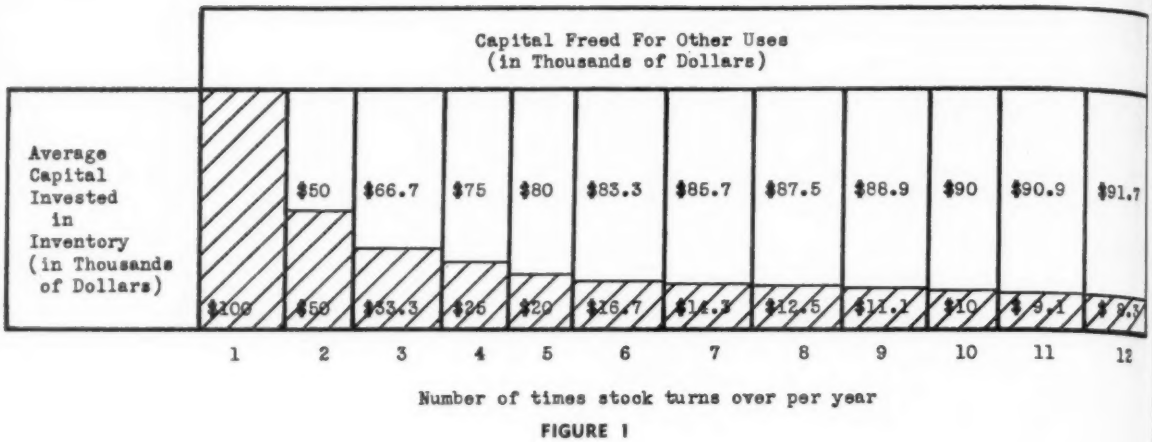


FIGURE 1

to insure an understanding of the use and application of the formulas.

The Classical Approach to Inventory Management

A vestigial remnant that emerged early in the formulation of an inventory management policy is the widespread emphasis on rapid turnover. A depression and a few recessions have tended to strengthen this philosophy, to the point where it pervades almost every type and form of industry, and has even entered the field of politics.

Increasing inventories in a period of peak production present an alarming situation that threatens the future well being of any particular industry, and also the national economy. Politicians and economists watch these inventories closely as a barometer of economic health, and pronounce grave warnings as inventories rise.

The psychological impact that results is usually sufficient cause to perpetuate the philosophy of rapid turnover.

Another factor, however, must be included which is of prime importance: Inventory represents capital investment, and in many cases enormous stagnations of otherwise workable dollars. The dollars invested in inventory are imprisoned from other use, becoming a relatively fixed part of the capitalization of the firm. As the inventories grow, this stagnation tends to increase. This condition is especially apparent with firms that operate under the LiFo system, wherein at the end of each fiscal year they try to return to the same inventory that was held the year before (for purposes of taxation).

The way in which capital investment in (finished goods) inventory is dependent upon turnover can be illustrated simply by Figure 1. This is based upon an annual sales, at cost, of $100,000. It will be noted that a turnover of once a year requires a $100,000 inventory, whereas a turnover of twice a year reduces the inventory to $50,000, releasing $50,000 in capital for other uses.

Firms that emphasize turnover usually strive for three to six turnovers a year. As the diagram points out, large inventories with a slow turnover will result in considerable risk with danger of serious losses.

The question immediately arises as to what is the best — the optimum — rate of turnover. For this question there is no simple answer, and in trying to supply one, we are introducing a fallacy into our thinking, which assumes that the answer is generally applicable to all of the inventory!

The question of turnover must be answered judiciously by analysis of individual cases and products.

Many competent men in Industry are of the opinion that the use of economic lot sizes will result in increased stocks, slowing the rate of turnover and increasing the business risks. In special cases, this opinion is justified. However, when it is true that economic lots mean increased inventory, it is also true that the company is not operating in the most economical manner. The company has **too high a rate of turnover!**

The principles enumerated here usually will reduce the inventory, freeing capital for other immediate needs, and will definitely lead the way for increased gross annual profit of the firm.

One must distinguish between the turnover of the total inventory and the turnover of the individual products. Whereas the total inventory may turn over every three months, there will be products within the inventory that will move only once a year and others that will revolve every month.

It is the determination of **these** exact relationships and economics that constitutes the first area of inventory management — order quantity analysis.

The problem of **when** to reorder and **how** much cushion to carry follows as a natural corrollary to the problem of quantity. These points will be discussed in the second part of this article.

ORDER QUANTITY ANALYSIS

WHENEVER SUPPLIES ARE ORDERED, whether they are for the office, for the machine shop or for parts to be used in an assembly, whether they are purchased or manufactured, there is a cost of placing the order. This cost of placing the order is frequently called the first order cost. It includes all costs such as machine setups, paper processing, receiving inspection and rush order costs that occur **each** time the order is placed.

Because these procurement costs may be very high, it is natural to order large quantities at a time. Some firms, for example, with very high setup costs will automatically order a year's supply of some items. The result is to build up large inventories with a failure to consider the effect upon other factors that come into play.

When an item is placed in inventory, it introduces a large number of costs for the firm that would not be incurred otherwise. An obvious cost is a need for storage space and personnel to handle the stock. It will be noted that costs such as these are a result of the **number** of items placed in stock rather than the cost of placing the order itself.

We can say, then, that there are two variable costs which must be considered in determining the most economical quantity to order:

1. Those costs that vary with the number of orders that are placed each year, which we will call **procurement costs,** and
2. Those costs that vary with the number of items placed in inventory each time, which we will call **carrying charges.**

Before going on, it might be well to pause and look more carefully at some of the factors that must be con-

sidered in deriving these costs and also to show how they are calculated.

Procurement Costs

It is important to remember that placing an order for an item, no matter how trivial or inexpensive, costs money. Each order that is written up and processed requires clerical time, administrative clearance, and paper and printing. Although such costs may be relatively low, they can become very expensive if they occur frequently enough.

Processing costs for placement of an order have been estimated to run from $5.00 to $15.00, and in some cases even higher. A similar condition is true of processing an order that has been received. Some companies will not even process an order for less than a fixed amount. They cannot afford to! It is cheaper to give the item away.

If the item being purchased is carried in stock at a warehouse or retail store, there is no direct charge for such items as setup costs and packing. In this case, the order processing costs alone are considered.

When the item must be placed into manufacturing, then the procurement cost must include the costs of any setups, testing, blueprint-study time, and such factors as inspection and quality control involved. In this case, these total procurement charges apply equally whether the item is purchased on the outside or manufactured in one's own plant.

In calculating procurement costs, only those costs which are accrued as each order is placed are included. In other words, resets and tool repair are excluded from procurement.

Quantity discounts are the rule for many items. If the discounts are known, along with the quantities, it is possible to calculate the hidden procurement costs. There are various methods for doing this, one of which is given below.

Suppose that in buying a flange from a warehouse, the price is quoted at $5.00 per flange for each order over 1,000 and $4.90 for each order over 2,000 flanges. How much is the procurement cost at the warehouse?

This problem can be solved by elementary algebra: Let x be the cost per flange and y be the cost of procurement.

Then 1000x is the cost for 1000 flanges and 2000x is the cost for 2000 flanges. If we add the setup cost (y), we get the cost of the order plus the cost of procurement.

Hence, $1000x + y = \$5{,}000$. Similarly, $2000x + y$ is the total cost for 2000 flanges. In other words, $2000x + y = \$9{,}800$. These two discounts thus give two equations in two unknowns:

1. $1000x + y = 5000$
2. $2000x + y = 9800$

Solving these equations simultaneously, we subtract the first equation from the second to get

$$1000x = 4800 \text{ or } x = 4.80$$

Therefore, the cost per flange is $4.80. Since 1000 flanges cost $4800, the setup or procurement cost (y) is $200.

Since the $200 represents the procurement cost at the warehouse, your own cost of processing this order would be added to this figure to get the overall procurement cost.

Although there are other ways to determine procurement costs when the quantity discount is given, the above method is as simple as any — unless the information can be obtained by direct inquiry.

In determining setup costs on machines or equipment, it is frequently difficult to arrive at a fixed figure because of the variability involved. On a machine, previous setups may be utilized to reduce the actual setup time. If order A follows B the setup may only be 2 hrs, whereas if A follows C the setup may be 20 hrs. Hence, the true setup time is largely dependent upon the sequence of the orders and the product mix of the time.

In cases where orders are placed in the shop to take advantage of sequencing, the setup costs should reflect these savings. In some companies, orders are grouped as families and placed into production for stocking purposes. The specific handling of families to determine lot size will be discussed later. It is sufficient to mention here that the first item in a family will involve a full setup and subsequent items or products will involve partial setups. If each item is to have its own economic order quantity, these setup costs must be prorated proportionately.

When the setup variations are a result of random sequencing of jobs, the setup costs to be charged are the average costs that have been experienced in the past. These may be obtained from cost variance reports or other cost data.

The procurement costs therefore will include all setup costs, direct and indirect burden charges for the time involved, and any tooling or design work that will vary with the number of orders placed. Procurement costs will also include acceptance inspection and all paperwork costs relating to initiating the order. In short, procurement costs are **all** costs, both in the office and the shop, that occur with each placement of an order, as distinct from those direct costs of producing each successive piece.

Carrying Charges

As was mentioned earlier, carrying charges are those costs that result from storing an item in inventory.

Carrying charges are usually computed as a precentage of the cost or value of the part, and assumed to be fairly constant for any quantity. At least one firm in my acquaintance uses a formula which varies with the quantity stored. Although this is somewhat more precise for some products, such variations are difficult to compute so that such a formula may be a spurious improvement over one which uses an average.

For practical purposes, the use of an average carrying charge as a percentage of the cost of the part has proven acceptable and is the one that will be included here. It might be well to point out that any economic order quantity obtained by formula must always be considered in the light of existing conditions. A formula is **never** a substitute for judgment, but rather is an aid in making sound decisions.

The next point to consider is what factors to include in carrying charges. The items listed below cover most of the elements that affect the carrying charges. These charges are computed on the basis of yearly costs and should be given in terms of percentage of the cost of the part.

Items to be Included in Carrying Charges:

1. Interest
2. Taxes
3. Insurance
4. Storage and handling
5. Maintenance of stock records at the warehouse
6. Obsolescence
7. Deterioration
8. Repackaging and rehandling

No attempt is made to make this list exhaustive. The conditions encountered in various operations vary so widely that the critical items can only be indicated. The specific items must be determined for each case. However, the ones listed above occur in almost every instance with slight variations.

For a typical firm, carrying charges on items stored for one year will vary between 15 to 25% of the cost of the part. There are instances where they will be lower, and in some cases they may run as high as 65% or more, depending on the type of product.

Some firms have taken the stand that the money invested in inventory could well be invested in productive equipment to return a greater yield on the investment. On the ratio of inventory versus present capital equipment, an estimate is obtained to determine how much profits would increase as a result of increased production. This "loss" in profits is then charged on a percentage basis as a carrying charge. A typical figure is 25 to 35%. If the firm really could realize such a return on their investment, they should borrow the money and begin expanding. They can still have their inventory and expansion too. For this reason the breakdown described above is considered most descriptive of the actual carrying costs.

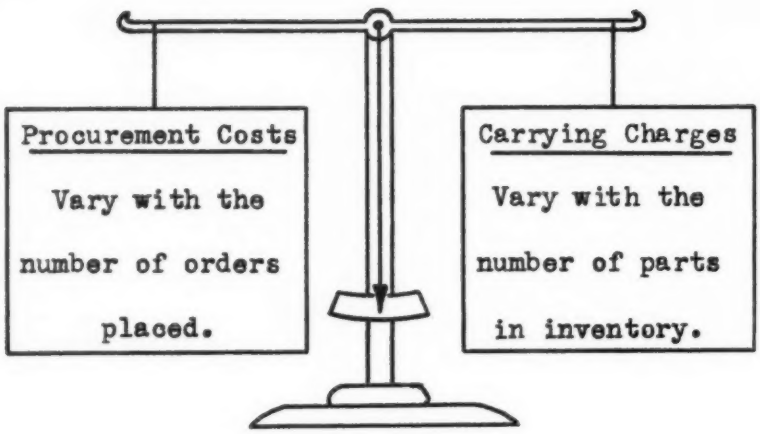


FIGURE 2

One company recently insisted that their carrying charges did not exceed 7%. This figure would be extremely hard to justify since the same amount of money invested in stocks and bonds alone would yield a return of 3 to 7%. Hence, interest is listed as a basic item in determining charges. Whether the money is borrowed to build stock or whether it represents capital on hand, any capital in inventory must involve interest considerations. One way to determine this figure is on the basis of what it would cost you to borrow the money.

Taxes include all taxes which are levied against the company which result from stocks in inventory.

Insurance is used to protect the company against loss due to unforeseen acts of nature. Since insurance charges are based on the value of the inventory, the charge easily converts into a percentage figure.

Storage and handling costs include heat, light, stock handlers, building maintenance and repair, depreciation of equipment, janitorial services, and other miscellaneous costs.

On a proration basis they can be assigned as a percentage of the value of the inventory.

Similarly, stock records which are maintained solely as a result of the inventory must be added to the costs. Some perpetual inventory records would be maintained whether inventory were stocked or not. As an example, records of sales and purchases may be maintained constantly without involving actual stocks of inventory. A merchant can process the order and purchase the item directly from the manufacturer. The product is delivered directly to the customer without ever passing through the merchant's hands. Hence, these costs cannot be charged against inventory. They are operating costs only.

Obsolescence costs are usually obtained from historical records. Obsolescence is not a material factor with some firms, and with others it is critical. In style goods and military products (automobiles, some appliances, fighter planes, and clothing), changes occur at frequent intervals rendering present lines obsolete. As styles change, excess stocks must be either marked down or otherwise disposed of. Since all items may have different risks involved, these obsolescence charges should be categorized by product lines, and prorated on such a basis.

Deterioration is another common occurrence with items stocked in inventory. Steel items tend to rust and have to be reworked or scrapped, silver tarnishes and must be reshined, rubber deteriorates completely and may become useless. Bearings and other moving precision parts are packed in grease and must be periodically cleaned and repacked. These costs again can be obtained from historical records and prorated as a percentage against the inventory.

Repackaging and rehandling may occur, for example, when an item is packaged in gross-size boxes and must be repacked in dozen-size boxes to fill an order. These costs are also included in the carrying charges, usually as a part of storage costs.

To summarize: Every one of these items, where appropriate, is included in the carrying charge, and this is assessed against the cost of the part as a percentage, based on the stock being in inventory for one year.

Carrying charges, therefore, are **all** costs that the firm accrues as a result of placing an item in inventory. Not like procurement costs, these costs vary with the number of parts put in inventory.

A Balanced Order Quantity

The relationship between procurement costs and carrying charges may be likened to an apothecary's scale as shown in Figure 2.

To determine the best or most profitable order quantity, it is necessary to weigh the cost of procurement against the cost of carrying the inventory.

To illustrate how these costs affect one another, consider the following typical example:

Example 1. Part A 601

Given the following data, what is the best ordering policy?

Procurement costs (per order) $16.00
Monthly usage (at cost) 256.00
Carrying Charge ..... $16\frac{2}{3}\%$ $(=1/6)$

The monthly usage is based on past history or forecasted usage. This is stated in terms of the average turn-over of the item per month at your cost, whether you buy it or sell it. The monthly usage figure to be used is actual cost of the part (or parts) not including setup costs.

Without careful consideration of all factors, it is quite possible for the above part to be ordered every month, every two months, once each quarter, twice a year, or perhaps even once a year. Let us compare these various order quantities on a cost-wise basis.

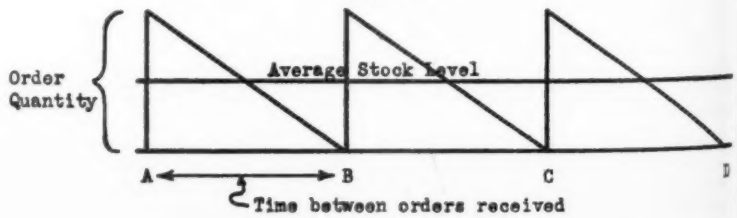
First, keep in mind that the two variables in this case are procurement costs and carrying charges.

If the order quantity is one month's supply at a time, the order will be placed twelve times a year. Therefore, the single procurement cost of $16.00 will be 12x16 or $192 for the year. If the order is placed every two months, there will be six procurements a year. The yearly procurement cost would thus be $96. Similarly, the other yearly procurement costs can be calculated.

If the order is placed monthly, the average amount of stock on hand during any one month will be half of $256.00, or $128.00, as shown in Figure 3.

The order quantity is assumed to arrive at Time A. As time elapses, the quantity is slowly used up until the next order is received at Time B. Hence, the average amount in inventory during the Time A-to-B is

FIGURE 3



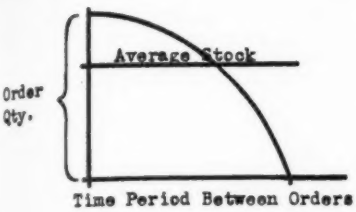


FIGURE 3A

one-half the order quantity. By similar reasoning, the average stocks on hand for a whole year is one-half the order quantity. Hence, for any ordering plan, the quantity on hand for a year will average one-half of the quantity ordered.

Figure 3 assumes that stocks are used on a linear basis — in equal amounts during the period they are in inventory. In actual practice, the usage may be slower or faster than that indicated.

Figures 3a and 3b show examples of slower and faster usage, respectively. The manner of usage, how-

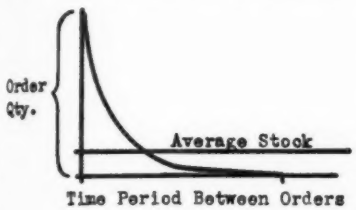


FIGURE 3B

ever, does not affect the validity of the reasoning presented here. Later on it will be shown that any of these disbursement patterns can be included in the calculations. A well planned inventory program would strive for a disbursement pattern such as shown in 3b because of the reduction in inventory. Such a program would plan stock receipts so that they would arrive just prior to mass usage, such as occurs in a seasonal industry.

Assuming a disbursement pattern such as given in Figure 3, the average amount carried in inventory for a year would be one-half of the order quantity. Since the carrying charge is ⅙ of the value of the inventory, the ⅙ is multiplied by the average inventory to get the yearly carrying cost. Hence for an order quantity of one month, the average stock is $128.00 and the carrying cost is ⅙ x $128 = $21.33. Similarly, the yearly carrying cost can be computed for any order quantity.

Figure 4 shows a comparison between different order quantities and yearly total variable costs (TVC).

The total variable cost (TVC) is the sum of the yearly procurement costs and the yearly carrying charges. The procurement costs for the year were calculated by multiplying the procurement costs per order by the number of orders per year. Similarly, the carrying charges for the year were calculated as described.

It will be noted that in this particular example, a 3-month order quantity, or ordering quarterly, is the most economical. In fact, any other order quantity increases the total variable cost. Figure 4 shows that arbitrary selection of the order quantity can actually double the TVC as seen in the 12-month column.

Through a series of additional examples, it will be shown that the optimum order quantity will vary widely depending upon the factors of procurement cost, carrying charge, and monthly usage. Hence, where a 3-month order quantity may be best for one case, a 1-year quantity may be best in another. Because of this fact, the economic order quantity must be computed individually for each product considered.

One way in which the economic order quantity can be calculated is by means of a graph such as that shown in Figure 5.

The carrying charge is plotted in terms of the pieces in dollars ordered at a time. Hence, if no parts are ordered the carrying charge is zero. These costs plot out to be a straight line. The number of procurements (and hence the costs) get very high as the number of pieces ordered at one time decreases, and approach zero as extremely large quantities are ordered.

The point at which the line and procurement curve intersect is the minimum cost. The economic order quantity is read from the axis marked "MIN."

If the "Line for Carrying Charges" and the "Procurement Cost Curve" are added together, the result is the "TVC curve" shown. The TVC curve is one-half of a hyperbola and is relatively flat in the area marked "Range".

The flat in the area of the curve marked "Range" indicates that there is very little change in total variable cost as the order quantity is varied within the range. This concept permits the exercise of judgment in determining the actual order quantity. For example, if the economic order quantity should be found to be 2.8-months supply to be ordered at a time, it is possible to use a quarterly ordering policy without a significant increase in cost. Since the TVC curve is flatter to the right of the "Min" point than to the left, it is more economical to increase the order quantity than to decrease it — should a change be indicated.

Knowledge of the flat around the minimum cost point can be used to increase the inventory turnover, or it can be used to build stocks in anticipation of increased usage, without materially increasing costs.

Although the graph in Figure 5 nicely illustrates the relationship between these various costs, it would be necessary to draw individual graphs for each product to get correct economic order quantities for each situation.

Because the TVC curve can be formulated algebraically, it is possible to obtain the economic order quantity directly by a simple formula using the following basic elements:

- P = procurement cost (per order placed)
- I = carrying charge for a year (in decimals)
- M = monthly usage at cost
- N_m = number of months supply to order each time.

In other words, we would like to find N_m.

The procurement costs for a year can be stated as follows:

1. $\frac{12}{N_m} \times P$

In other words, if we order three-months supply each time, then $N_m = 3$, and we will pay four procurement charges a year. Thus, $\frac{12}{N_m}$ = the number of orders placed per year, and if the number is multiplied by P, we get the yearly procurement costs.

The yearly carrying charge can be stated as follows:

2. $\frac{N_m \times M \times I}{2}$

Again, N_m is the number of months supply to order each time and M is the usage in dollars by months.

FIGURE 4

	Order Quantity (in Months Between Orders)				
	1	2	3	6	12
Avg. Inv. in Stock	$128.00	$256.00	$384.00	$768.00	$1536.00
Yearly Carrying Cost	21.33	42.67	64.00	128.00	256.00
Yearly Proc. Costs	192.00	96.00	64.00	32.00	16.00
TVC	$213.33	$138.67	$128.00	$160.00	$ 272.00

N_m x M is, therefore, the order quantity in dollars. Only half of the order quantity is in stock on the average for a year (as discussed earlier), so that $\frac{N_m \times M}{2}$ is the average amount in stock. I is multiplied by this average stock to get the yearly carrying charge.

Adding equations 1 and 2 above gives the TVC as described in Figure 5.

$$3.\ TVC = \frac{12}{N_m} \times P + \frac{N_m MI}{2}$$

The equation for TVC is a hyperbola. Those of you who remember your calculus will recall that it is possible to determine the minimum point on a curve by taking the derivative of the equation (3) and setting it equal to zero. (It will be noted here, that any constant costs which might have been appended to 1, 2, or 3 would have dropped out at this time, and are thus insignificant to the answer.)

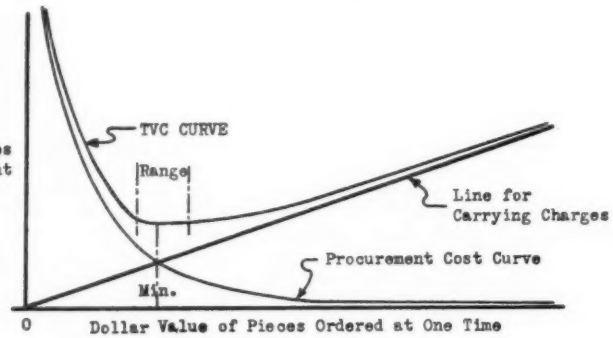


FIGURE 5

When these steps are carried out, the formula to find the economic lot quantity N_m becomes:

$$\text{Formula 1.}\ N_m = \sqrt{\frac{24}{I} \times \frac{P}{M}}$$

The discussion involved in developing Formula 1, through steps 1, 2, and 3, now can be forgotten. This was used to demonstrate the reasoning behind the formula. For our purposes, we are interested solely in Formula 1.

It is now possible to apply the economic lot formula to the example discussed earlier. It will be noted that:

P = \$ 16
M = \$256
I = 1/6

The values for P, M and I are substituted into Formula 1 to find N_m:

$$N_m = \sqrt{\frac{24}{1/6} \times \frac{16}{256}} = 3$$

Hence, the economical order quantity is a 3-months supply to be ordered at a time. This answer is the same as the one obtained by comparing the costs of various ordering policies given by Figure 4. The advantage is that the formula gives the best answer with one calculation, whereas comparison may require a number of trials before the best answer can be obtained.

Consider the following situation:

Example 2. Part B 83

Given the following data, what is the best ordering policy?

Procurement costs	\$10
Monthly usage in pcs.	10
Cost per piece	\$ 1
Carrying charge	1/6

In this example, M is equal to the monthly usage in pieces times the cost per piece. Hence:

P = \$10
M = \$10
I = 1/6

Then:

$$N_m = \sqrt{\frac{24}{1/6} \times \frac{10}{10}} = 12$$

In other words, the economic order quantity is a year's supply to be bought at a time.

Now, consider the following example:

Example 3. Part A 603

P = \$ 10
M = \$1000
I = 1/6

Then:

$$N_m = \sqrt{\frac{24}{1/6} \times \frac{10}{1000}} = 1.2$$

Here, the economic quantity is 1.2 month's supply at a time.

The variation in these three examples shows the error that would be created by a flat turnover policy applied to the whole inventory. In the case of these three examples, the average turnover rate for the total inventory is 7.3 times per year. Compare this to a turnover of four times a year for example 1, once a year for example 2, and 10 times a year for example 3. The comparison is shown below in Figure 6.

The 7.3 for the total inventory represents a relatively fast turnover, despite the fact that one item in that inventory is turning slowly. In addition, the fast turnover is obtained at the greatest economy to the operation.

In example 2, a year's supply was to be ordered each time. It is worth noting, here, that there will be times when the formula will indicate ordering several years supply at a time (for some items). When this condition arises, company policy will usually dictate a maximum order quantity of one year's supply. Such a policy is the result of applying judgment to a situation which extends beyond the realm of reasonable certainty. The risk for extremely large order quantities (those that exceed one year) may be too great to warrant the additional savings. Usually, items that involve large quantities are slow movers.

Other Solutions

1. In the preceding sections, it was assumed that the rate of disbursement followed the pattern indicated by Figure 3. It was furthermore stated that any rate of disbursement could be used in the formula.

In Figure 3, the average stock in inventory was ½ of the order quantity. In Figure 3a, the average is about 2/3 of the order quantity, and in Figure 3b, the average is about ¼ of the order quantity.

When the rate of disbursement is known, these averages can be calculated to fit the pattern of any firm.

The economic order formula then becomes:

$$\text{Formula 1a.}\ N_m = \sqrt{\frac{12}{aI} \times \frac{P}{M}}$$

where "a" is the average stock in inventory in terms of the order quantity. In other words, for Figure 3, a = ½ and for Figure 3a, a = 2/3. In most cases, a = ½ and hence Formula 1 would apply.

2. Depending upon the manner in which the inventory records are kept, it may be advantageous to arrive at the order quantity in terms of dollars or pieces rather than months. These new formulations are given below:

$$\text{Formula 2.}\ N_s = \sqrt{\frac{24}{I} \times PM}$$

$$\text{Formula 3.}\ N_p = \sqrt{\frac{24}{I} \times \frac{PM}{C}}$$

where C is the cost per piece, and all the other symbols under the square root sign are the same as defined earlier.

Applied to example 2, Formula 2 gives:

$$N_s = \sqrt{\frac{24}{1/6} \times 10 \times 10} = \$120$$

Similarly, Formula 3 gives:

$$N_p = \sqrt{\frac{24}{1/6} \times \frac{10 \times 10}{1}} = 120 \text{ pcs}$$

Putting the Formula to Work

Classification of stock: Inventories usually follow a pattern such that a relatively few part numbers represent a large part of the dollar volume. For example, in one case, 15% of the total inventory represented

85% of the dollar sales. A properly designed inventory control system will put greater emphasis on the control of items such as these, than it will on slow moving items.

A similar concept applies to the use of an economic quantity formula — to "inventory management".

To use the formula involves developing accurate data on each product: accurate forecasted usage; accurate costs; and application of the formula itself. Since obtaining this data represents an additional expense to the firm, there is a breakeven point below which it is inadvisable to use the formula.

Furthermore, it may be impractical to compute this break point for each product. Hence, some rules of thumb have been developed which have proven practical as well as economical. These are:

1. Classify the inventory into A, B, C, and D products, where A products are the high dollar volume items, B products the intermediate movers, C the low dollar volume items, and D the inactive products.

2. It may also be necessary to distinguish between special and standard items: Many special items are produced only once to meet customer specifications; other special items may be repetitive, but subject to change at any time. Examples being military parts and paper products.

3. Products in the A classification are to be carefully analyzed with respect to procurement and carrying charges and require accurate forecasts. These products should all be ordered by formula.

4. Products in classification B are less critical and permit less accuracy. These products should be ordered by formula.

5. Products in classification C are usually ordered according to a stated policy, such as once a year.

HANDLING SPECIAL PRODUCTS

In manufacturing special products, such as paper boxes with advertising printed on them, the printing may be changed with each order. Analysis will usually show that with some of the items there is a history of repeated orders with changes occurring, perhaps once every five orders on the average. This situation actually existed in one plant that was analyzed.

In their case, the setup costs were running about $100 and the production time per order averaged from one to six hours. In addition, production of these particular items was for special products which were subject to constant change. A study of the product line showed that 80% of the products were so irregular that production should be to customer order only. However, 20% of the products had a history of several repeats before a change occured. If an order was known to average 5 repeats before a changeover, it was a simple matter to balance the procurement costs against the carrying charges and the probable liquidation loss of any over-run. In problems such as these, carrying charges are usually insignificant compared to the liquidation costs so that they can be ignored in many cases.

	Order Quantity	Yearly Sales	Times Inventory Turns Per Year
Example 1	$ 768	$ 3,072	4
Example 2	$ 120	$ 120	1
Example 3	$1,200	$12,000	10
Total	$2,088	$15,192	7.3

FIGURE 6

Problems of this nature are comparable to the style goods case, which will be discussed in a later section, and involve the concept of marginal analysis.

To illustrate the procedure, consider the following example: For a certain box, records show that the order was repeated once and then changed; repeated twice and then changed; no repeat; and repeated three times and then changed. If this pattern is typical, we can assume that there is a ¾ chance of a single repeat, a ½ chance of two repeats, and a ¼ chance of three repeats. The procurement cost for the box is $100 and the cost of the order is $200.

The answer we seek is the optimum production policy subject to the stated conditions.

The solution is given by an inequation:

$$P_{p1} + P_{p2} + P_{p3} > C_{q1} + C_{q2} + C_{q3}$$

Where P is procurement cost, p_1, p_2 and p_3 are the probabilities of selling one, two or three excess orders, C is the cost of each order (the liquidation loss), and q_1, q_2 and q_3 are the probabilities of **not** being able to use one, two or three excess orders, respectively, because of an unforeseen change. The left side of the inequation represents the savings in procurement costs, and are to exceed as much as possible any losses due to change.

In the example, P = 100, C = 200, $q_1 = ¼$, $q_2 = ½$ and $q_3 = ¾$, and $p_1 = ¾$, $p_2 = ½$ and $p_3 = ¼$.

Substituting these values in the appropriate parts of the equation, we get:

One Excess Order:

$$100(¾) > 200(¼)$$
$$75 > 50$$

Two Excess Orders:

$$100(¾) + 100(½) < 200(¼) + 200(½)$$
$$75 + 50 < 50 + 100$$

Three Excess Orders:

Not necessary to compute

Hence, the best policy is to produce one excess order each time an order is received. By doing this, we will save an average of $75 each time on procurement costs, and will average a $50 loss. The net gain is $25. In other cases, the losses exceed the gains.

The more the left side of the inequation exceeds the losses, the higher will be the savings.

It will be noted that the methods described here will tend to increase productivity by reducing the number of setups. This fact is generally true of all economic lot formulas. Wherever costly setups are involved, the tendency will be to increase the length of the production run, and thus result in fewer setups.

Families of Products

Families of products may be divided into two types: related and non-related.

Non-related products occur in families when they are brought together to form an assembly. Each part may have its own setup and production process. The parts are related only by usage. An economic quantity can be calculated for each individual part in the assembly, thus creating separate stock levels for each part. If the parts are used solely in the assembly, it may be desirable to compute the economic quantity in terms of the assembly,

FIGURE 7

		Values for M									
		10	20	30	40	50	60	70	80	90	100
Values for P	10	11.0	7.8	6.4	5.5	4.9	4.5	4.2	3.9	3.7	3.5
	20		11.0	9.0	7.8	7.0	6.4	5.9	5.5	5.2	4.9
	30	Order one year's supply		11.0	9.5	8.5	7.8	7.1	6.7	6.4	6.0
	40				11.0	9.7	9.0	8.3	7.8	7.3	7.0
	50					11.0	10.0	9.3	8.7	8.2	7.8

using the combined procurement costs to obtain the assembly procurement costs.

An analogous situation occurs in the production of a product through several types of equipment. It is possible to compute the economic quantity for each type of equipment, in terms of semi-finished parts, or the economic quantity can be calculated as the end product from all machines. The economic quantity in terms of work-in-process inventory requires a bank or storage area between machines. It has the advantage of stocking goods in the least expensive state and holds them ready for the next stage of production.

Work-in-process inventory also permits variations in the end product at little cost, which might not be possible otherwise. In this sense, one basic item in in-process inventory may be sufficient, whereas finished inventory may require stocks of each variation of that item. Hence, work-in-process inventory total-wise will generally be much smaller than finished goods inventory to accomplish the same purpose. The disadvantage is the need for considerable storage space between the types of equipment. Both methods are used and should be studied carefully with respect to the specific situation before one plan is discarded in favor of another.

Related families are those products which are only variations of a type of product. One method for handling these has just been considered. That is: The product can be brought up to the point of completion, just before the variations take place, and stored, or each variation can be produced and stored. Since related families work from the same or similar setups, the total setup time is prorated to each item, if separate order quantities are to be calculated.

The Clerical Procedure

It is not always advisable to calculate the economic order quantity every time an order is placed or a change occurs. In addition, it is desirable for clerical purposes to eliminate the use of a formula entirely, thus simplifying the procedure and increasing the speed of assimilation of the techniques into the present practices.

The method to be outlined here, requires that the computations be made only once and the results be tabulated. This tabulation is made in a general manner so that the results encompass the whole inventory activity. Thereafter, the inventory clerk refers to the tabulation to determine **any** economic quantity desired. This new economic quantity is posted to the perpetual inventory sheet in the upper right corner until a change in costs or volume necessitates a new economic quantity. At which time, the tabulation is again consulted, thus completely circumventing the formula.

The reason for considering the formula in this paper is that it is necessary to use the formula to build the table. Since the table will vary depending upon your operation, each firm should compute their own. In addition, one person, at least, in the firm should understand the method for deriving the table so that any unusual situations can be properly handled.

The first step in setting up the table is to select the appropriate value for I (the carrying charge). For illustrative purposes, assume that your carrying charge is 20% a year. Since this figure is now fixed, the formula becomes:

$$N_m = \sqrt{\frac{24}{.2} \times \frac{P}{M}} \simeq 11 \sqrt{\frac{P}{M}}$$

Recalling that the TVC (total variable cost) curve is flat at the most economical point, the next step is to substitute values for P and M, in discrete steps, which cover the range of procurement costs and monthly usage (at cost) for all parts, purchased or produced in your plant. Substituting the appropriate values of P and M in the formula gives a table such as shown in Figure 7.

In Figure 7, the procurement costs range from \$10 to \$50 and the monthly usage at cost runs from \$10 to \$100. The figures inside the table are the number of months supply to order each time.

To use the table, the inventory clerk selects the appropriate value of P and M and reads off the order quantity. For example, suppose the sales forecast of an item has changed and the new monthly usage is \$80 and the procurement cost is \$40. Selecting the appropriate P row and M column in the table shows that the order quantity should be 7.3-months supply. The 7.3 is then written on the perpetual inventory card until another change occurs.

Obviously, such a table can be extended to encompass any range of sales and procurement costs. Furthermore, for greater accuracy, the table can be interpolated to obtain the order quantity for those values of P and M which fall in between those given by the table.

Because more than one carrying charge may apply to different product lines, it is possible to develop separate tables for each distinct carrying charge — 15%, 20% and 25%, etc. if needed to cover the inventory.

Once the table (or tables) has been developed, a copy of it is reproduced and given to each inventory clerk for ready reference.

By use of the table, it is possible to obtain complete flexibility in making changes and maintaining current records. It is simple to train people to use, and, not the least important, it is economical to use.

end of part I

In our next month's issue, Mr. Reinfeld will discuss Reorder Point Analysis and Miscellaneous Inventory Problems, including Safety Allowances in Continuous Production.

"MECHANISMS" AN INTERNATIONAL BIBLIOGRAPHY

In spite of the impact of electronics, hydraulics, and nuclear physics on modern industry, many of its problems, both now and in the future, will still have to be solved by purely mechanical means, and the better these are, the greater will be the efficiency and productivity of the industries concerned.

While information on the theory and practice of mechanisms is more widely dispersed at the present time than ever before, it is nevertheless very doubtful whether this information or at least an important part of it, ever reaches those who are most in need of it.

In order to disseminate this important information an international bibliography is being compiled to list, index, classify and abstract the papers, articles, and books on mechanisms which appear in the literature of all the most important industrial countries.

The bibliography is divided into eleven classifications, such as: principles of kinematic design; linkage; screws and wedge mechanisms; cam mechanisms; etc.

Each monthly issue will contain the subject matter of three of the classified groups, so that after the fourth issue all of the subjects will have been dealt with as far as limitations permit.

As an example as to the manner in which the material is arranged, one item is taken from our January 1955 issue:

Device for drawing arcs of very large radius, Naval Research, Tooling and Production, 1955 Vol. 21 (2) p. 153.

Application of the Peaucellier 8-bar-linkage, for drawing large arcs. Extract from Research Reviews, one illustration.

The bibliography is compiled and edited by P. Grodzinski, Dr. Ing. A. M. I. Mech. E., 41 Tudor Close, Belsize Avenue, London, N. W. 3. England, and is distributed on an annual subscription basis.

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JOB FACTS: Rolling a 5/8"-18 thread in C-1117 steel on a Type N-2 self-opening Acme-Fette Thread Rolling Head.

even on this short run

threading costs reduced from 50 cents to 1 cent per piece

As reported by Mr. Arnold Thompson, President, Thompson Tool and Manufacturing Company, Franklin, Ill., manufacturers of the "Dress-O-Grind" grinding fixture.

When thread chasing failed to provide the required finish for this Class 3 thread fit air rotor—and thread grinding proved too costly—this manufacturer turned to *thread rolling*, using the versatile* new N-2 Acme-Fette Self-opening Thread Rolling Head, on a hand screw machine.

"As a result," states Mr. Thompson, "on a test run of only 1000 pieces, our threading cost dropped from 50 cents to one cent per piece . . . and we maintained the finish we had to have throughout the run, without a single adjustment."

While the Acme-Fette Thread Rolling Head has built its reputation on long runs (often running into the millions) don't overlook the many advantages it offers—*even on short runs!*

*THREADING FROM THE END IS NOW POSSIBLE ON YOUR PRESENT ROTATING OR NON-ROTATING SPINDLES

•

Provides smooth, extremely accurate and tougher threads—without chips—up to 5 times faster than thread cutting methods.

National Acme

THE NATIONAL ACME COMPANY, 169 E. 131ST ST., CLEVELAND 8, OHIO • Sales Offices: Newark 2, N. J., Chicago 6, Ill., Detroit 37, Mich.

if you manufacture parts

like these...

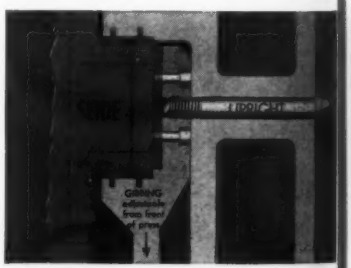
A BLISS HIGH PRODUCTION PRESS

may triple your output...or more

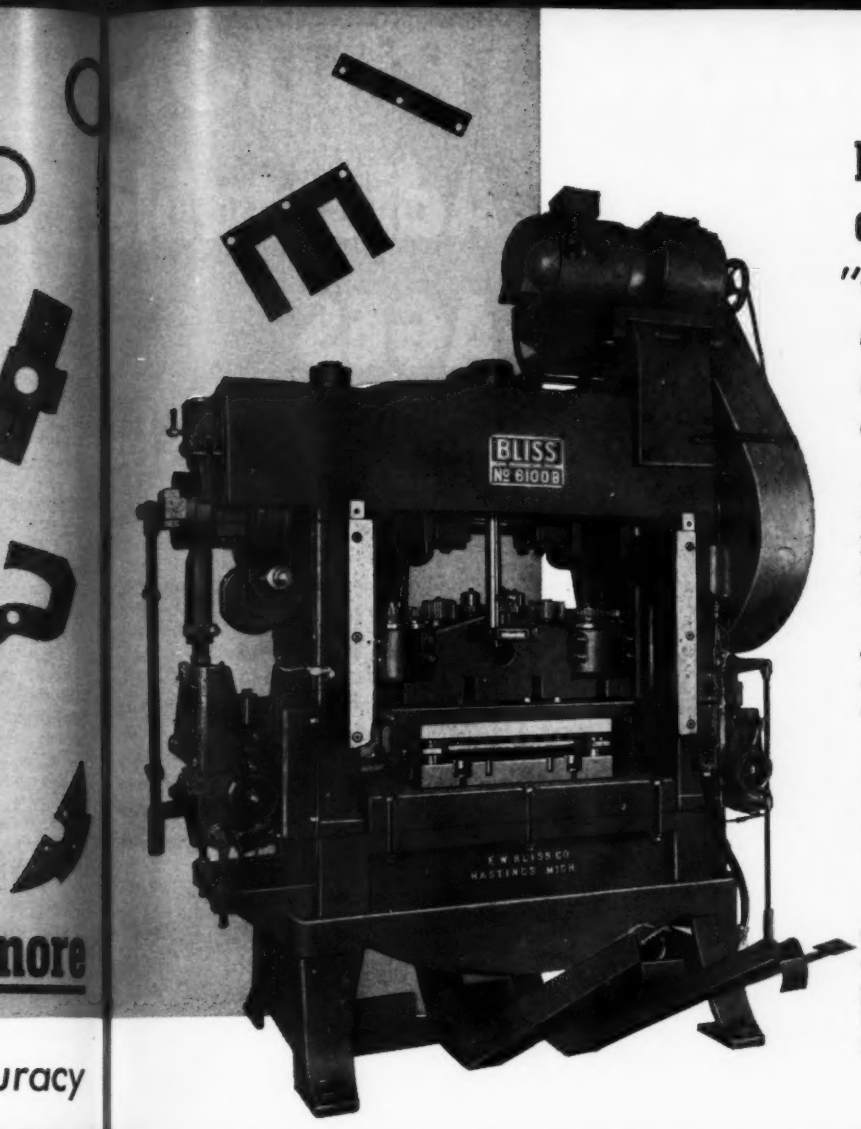
EXCLUSIVE DESIGN FEATURES..assure accuracy at high speed

RUGGED FRAME: The dense, cast Meehanite frame *absorbs sound*, eliminates ringing "ping" at high speeds. Heavy four-piece frame members are keyed and joined by steel tie rods which are "pre-shrunk" to a tension greatly exceeding press capacity. Extra heavy sectioned bed and crown holds deflection to a maximum of 0.001" per foot at press capacity under normal loading conditions. Heavy reinforced crown gives extra support to the shaft. The design of the frame leaves plenty of room for die set up—provides chute space *under* the press.

VARIABLE SPEED DRIVES are standard on H-P presses so that each job can be run at its most efficient speed.



SQUARE GIBS provide precision fit—no more than a 0.0015" feeler goes between gib and slide, although slide moves freely. Location of gibs close to centerline resists tendency of slide to tilt under off-center loads—slide is held parallel to bed within 0.0005" per foot on all dimensions.



Long runs not essential, users report

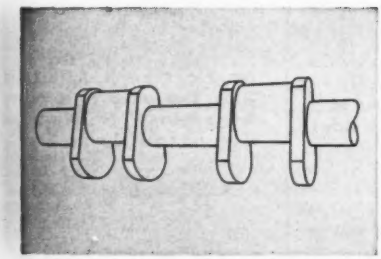
"we set up in 15 minutes, run 3000 parts in another 10..." is typical experience

Consider this: a Bliss H-P Press is usually able to replace from 3 to 12 older and slower presses. And the savings in space, tooling and handling costs alone are often enough to write off the cost of a H-P press.

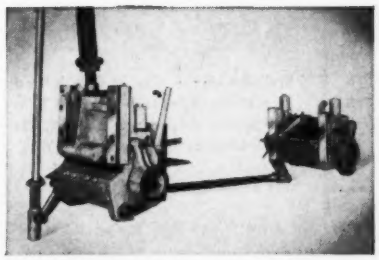
But the really important saving is in the cost of the parts themselves, because you get so many more so much faster and dies last so much longer.

Fast set-up makes that true for both long and short run work. IBM, for example, needs only *eleven* H-P presses to turn out multi-thousand quantities of more than 1500 different parts every three months. Their average set-up time: 48 minutes.

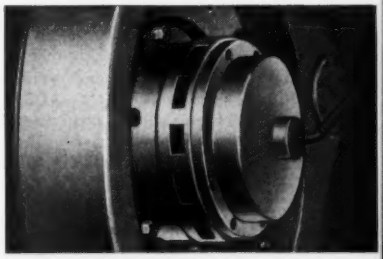
H-P presses are available from 12 to 300 tons, non geared or single geared. Special designs, special feeds extend their use to practically all stamping requirements. We'll be glad to send you complete information by return mail.



COUNTERBALANCED to eliminate vibration. Slide and tools are counterbalanced by means of air cylinder in crown. Where top speed of press requires, the crankshaft is dynamically balanced and the throwblock for the feed is balanced by a compensating weight on the feed adjusting screw.



BLISS FEEDS: Bliss makes its *own* single roll, double roll and special feeds to assure accurate feeding at high speeds. Typical of Bliss design is its roll feed clutch—with *eight* or more rollers bearing on *Stellite* inserts in the hub, it gives greater accuracy *longer*.



AIR FRICTION BRAKE AND CLUTCH: Special design gives die setter and operator complete and accurate control of the press. Air pressure can be set so clutch will slip under severe overloads. In addition, this cool-running clutch automatically adjusts itself for wear.

BLISS
SINCE 1857

is more than a name...it's a guarantee

E. W. BLISS COMPANY, Canton, Ohio

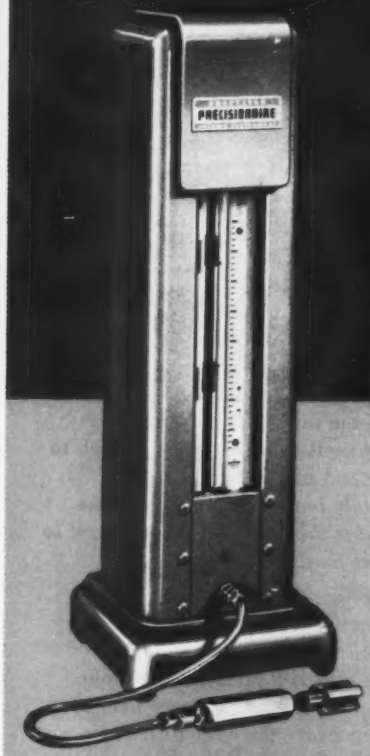
PRESSES, ROLLING MILLS, SPECIAL MACHINERY

U. S. Plants in Canton, Cleveland, Salem and Toledo, Ohio; Detroit and Hastings, Michigan; San Jose, California; Midland and Pittsburgh, Pennsylvania. ***Branch Offices in*** Burbank, Chicago, Cleveland, Dayton, Detroit, Indianapolis, New Haven, New York, Philadelphia, Pittsburgh, Rochester, San Jose, Toledo, Washington, D. C., and Toronto, Canada; E. W. Bliss (England) Ltd., Derby; E. W. Bliss Co. (Paris), France. ***Other representatives throughout the world.***

FREE DEMONSTRATION

SHEFFIELD Adjustable AIR GAGES

for Short Runs and Emergencies



SUCH AS:

- Aircraft manufacturers, subcontractors and job shops having limited production.
- Accidental damage to a vitally needed single purpose gage.
- An unexpected engineering change involving part size.
- A short run of special parts for which no gages have been provided.
- A mistake or failure in ordering the needed single purpose gages.
- Sudden need for process gages at the production machines.

Don't let any of these situations cause costly scrap, delays or embarrassing confusion in inspection, in the shop or in the toolroom. A small investment in the adjustable air gages here illustrated is your best insurance against unpredictable production losses. *The Sheffield Corporation, Div. #20, Dayton 1, Ohio, U.S.A.*

ADJUSTABLE BALLJET SPINDLE KITS
1" to 3"

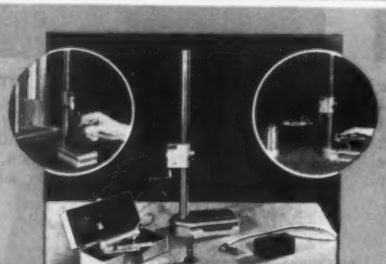
In 5 minutes you can assemble, for precision gaging, a spindle for ANY SIZE hole from 1" to 3". No auxiliary equipment needed except conventional gage blocks—NOT EVEN ONE MASTER SETTING RING.

ADJUSTABLE AIREBORE GAGE KITS
3" to 12"

The Airebore Gage can be set precisely to any diameter from 3" to 12" by means of a calibrator and gage blocks. No master rings are needed.

PLUNJET ADJUSTABLE SNAP GAGES
0" to 12"

Twelve Plunjet Adjustable Snap Gages cover a gaging range from 0" to 12"—Larger sizes on special order.



AIRETEST AND PLUNJET STAND

This stand accommodates an Airetest indicator—also converts to a comparator or height gage by using a Plunjet or dial indicator and anvil.

SELF-CENTERING ADJUSTABLE SPINDLES
½" to 3"

Four Self-centering Adjustable Spindles cover respectively the ranges of ⅝" to ⅞", ¾" to ⅞", ⅞" to 1½" and 1½" to 3". All but the smallest can be set with gage blocks.

STANDARD ADJUSTABLE AIRSNAPS
¼" to 5½"

Available in 17 models to cover the range .2500" to 5.500". Up to 3.000" the anvil has an adjustment of ¼"—above that, ½".

GOLDEN ANNIVERSARY — MASTER CRAFTSMEN — HEADQUARTERS

SHEFFIELD

manufacture and measurement for mod

Call Your Sheffield Representative for a Demonstration in Your Plant

Dimpled Insert Simplifies Placing Brazing Alloy

The assembly shown, part of a Columbia bicycle frame, is a vertical member which supports the seat post. Because of the large stresses encountered in service, the upper end of the tube is reinforced with a short tubular insert. The tube and insert are subsequently brazed together.

The short inserted piece is coiled from flat strip into cylindrical shape, leaving about a ¼" gap to permit some radial compression. The piece is coiled slightly oversize to provide a force fit and thus keep it securely located inside the long tube until the two parts are permanently brazed together. The nature of the assembly created a problem of how to preplace the Easy-Flo 45 silver alloy, since the brazing is done on automatic equipment. The problem was solved ingeniously by pressing a dimple on each side of the insert with an automatic die punch at the same time the piece is formed by the coiler. The piece of brazing alloy can then be nested in the punched depression.

To make the assembly, the operator (after first wire-brushing the tube to remove oxides) lays a piece of brazing alloy in each depression and, holding them in place with his fingertips, taps the insert with a mallet part way into the tube. At this point he brushes the protruding half of the insert with Handy Flux, and then taps the insert down until it is flush with the top of the tube. In this manner, the two pieces are assembled with both the brazing alloy and flux properly preplaced between the two surfaces to be joined. When the assembly is heated to brazing temperature, the Easy-Flo silver alloy, manufactured by Handy & Harman, 82 Fulton Street, New York 7, N. Y., distributes itself uniformly by capillary action, making a solid continuous joint between the tube and reinforcing insert.

F. Jos. Lamb Co. now uses Barnes Rocket Hack Saw Blades for low cost slotting operation.

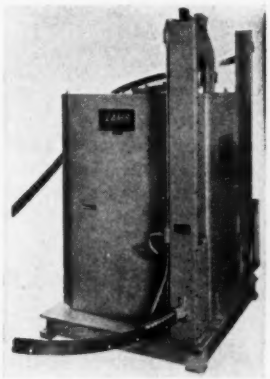
BARNES

POWER HACK SAW BLADES

SAVE $360.00 PER DAY

Slotting a set of 8 support arms was costing the F. Jos. Lamb Co. $60.00. The problem was presented to a Barnes' field engineer. He gathered the facts, including one that Lamb was seriously considering the purchase of new equipment for the job costing approximately $2,000.00.

The Barnes engineering department, after thorough study, recommended that the slotting be done by hack sawing. Barnes Rocket Blades, RT 1406-6, would give the correct slot width and insure straight, accurate cuts. A special fixture was designed adapting one of Lamb's hack saw machines (Cost: *less* than $200.00).



F. Jos. Lamb's new Stor-Matic Hitch-Lift is placing automation within the reach of all manufacturers. The Stor-Matic automatically stores and feeds semi-processed parts between standard machine tool operations.

The result—production of 4 sets for the previous cost of 1 set. Based on two shifts, this is a savings of $360.00 per day. In addition, F. Jos. Lamb Co. is obtaining more cuts per blade from Barnes Rocket Hack Saw Blades and immediate delivery from the stock of their local Barnes distributor.

The services of an experienced Barnes metal cutting engineer are available to you through your Barnes distributor. His recommendations on your hand, power or band saw requirements will increase your production and lower costs. Call your Barnes distributor today.

when cutting counts BARNES *count on Barnes*

W. O. BARNES CO., INC.

1297 TERMINAL AVENUE DETROIT 14, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 89

MANUFACTURING MEMOS

● Major organization changes have been disclosed by Lamson Corp. Under the new plan, the company will have two separate sales and engineering groups — Engineered Systems and Allied Products. Carroll Hennessy will manage Engineered Systems and Vernon C. Story, Allied Products.

Acquisitions . . .

● American Optical Co. has acquired J. W. Fecker Inc. of Pittsburgh, producer of astronomical equipment and optical devices for the military services. The company will be operated as a wholly-owned subsidiary without change in personnel. As part of the purchase, American Optical also acquired the assets of Akeley Camera Co. which was taken over by Fecker last year.

● Kendrick Mfg. Co. has been purchased by Superior Brass Works, Inc. The company will be operated as the Kendrick Division. Both Superior Brass and Kendrick make cast bronze bushings and bearings.

● The Sterling Foundry Co., Wellington, Ohio, subsidiary of The Warner & Swasey Co., has obtained Brown Industries, Inc., a Sandusky, Ohio foundry. The newly acquired firm will be operated as an independent unit under Sterling Foundry management.

New Organization Formed . . .

● Dynex, Inc., a new engineering, manufacturing and sales organization, has been formed. It is a development of the Hydraulic Control Division of Blackhawk Mfg. Co. Phillip G. Brumder, Blackhawk's president, will serve as president and general manager. Its products consist of a complete line of hydraulic piston pumps, valves, motors and cylinders.

National Safety Council Award . . .

● For its work in the promotion of safety in small business, The National Tool & Die Manufacturers Association has received an award.

● A $5,500,000 building addition to The Lincoln Electric Co. is now under way. The 456,000-sq-ft addition will be ready for occupancy in the fall of 1957. It will provide additional space for electrode and machine production in view of the rising demand for welding equipment.

American Brake Shoe Co. has announced that The Denison Engineering Co., a wholly owned subsidiary, has become a division of the company. Denison manufactures hydraulic presses, hydraulic pumps, motors and automatic controls for aircraft and industrial uses.

◆

Ross Operating Valve Co. is celebrating its 35th anniversary. Along with that, the company has disclosed the completion of its one millionth job-engineered air control valve.

◆

The Wallco Manufacturing Division has been formed by Wall Colmonoy Corp., to manufacture heat treated, brazed assemblies using tubular, stamped and machined components. Wallco was formerly known as the Furnace Brazing Division. Frank R. Reynolds was named general manager of the new division.

◆

Amgears, Inc. will now be known as Hupp Aviation Co., a subsidiary of Hupp Corp. This firm, headed by T. V. Purvin, president, will coordinate all aviation and government product activities for Hupp Corp.

◆

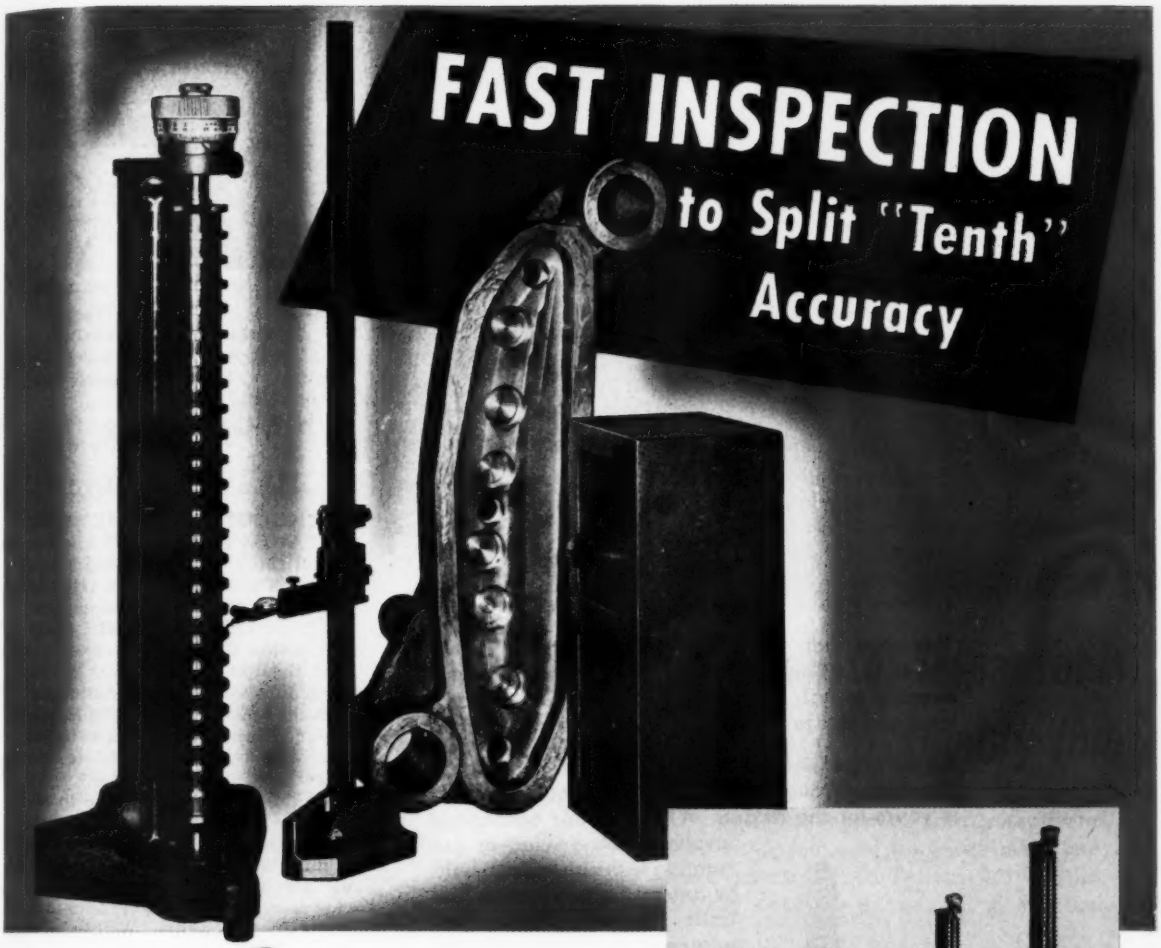
New offices have been opened at 93rd St. and Kenwood, Chicago, by Verson Allsteel Press Co. These offices add 6,000 sq ft to existing offices.

◆

Establishment of a Controls Division to manufacture and distribute a diversified line of "package" industrial controls for electrically measured functions has been disclosed by Tipp Mfg. Co. All field sales problems involving the new line of controls will be handled by David J. Dolan. The new chief engineer for the division is R. A. Moenich.

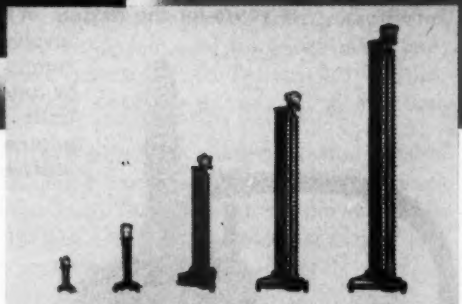
◆

Additional facilities in Lebanon, Ind., have been acquired by Ferguson Machine & Tool Co. The new plant known as the Hicks Development Division, will be devoted to the design and building of automatic tooling for use with the company's basic transfer units. The company has also announced a change in firm name to Ferguson Machine Corp. of Indiana.



Cadillac PLA-CHEK

Height gage and micrometer settings are 5 to 20 times faster with Cadillac PLA-CHEK than with other methods of comparable accuracy. Less than 15 seconds establishes *any* dimension within a 24" range to limits of less than .0001". No auxiliary gage blocks necessary—PLA-CHEK is totally self-contained. Dimensions are taken from the surface plate or from a base line on the work. Send coupon TODAY for complete details!



Cadillac PLA-CHEK Gages are available in a complete range of sizes from the easily portable 6" and 12" models for smaller jobs, to 24", 36" and 48" models for larger inspections. Precision-made risers may be used with PLA-CHEK Gages —increasing the range of each 6" to 12".

Cadillac
GAGE COMPANY
P. O. BOX 3806 · DETROIT 5, MICHIGAN

MAIL THIS COUPON FOR COMPLETE DATA

CADILLAC GAGE COMPANY
P. O. BOX 3806, DETROIT 5, MICHIGAN
Without obligation please rush complete information on the Cadillac PLA-CHEK Gage line to:

Name_____

Company_____

Address_____

City_____ Zone____ State_____

CIRCLE INFORM-A-GRAM KEY NO. 91

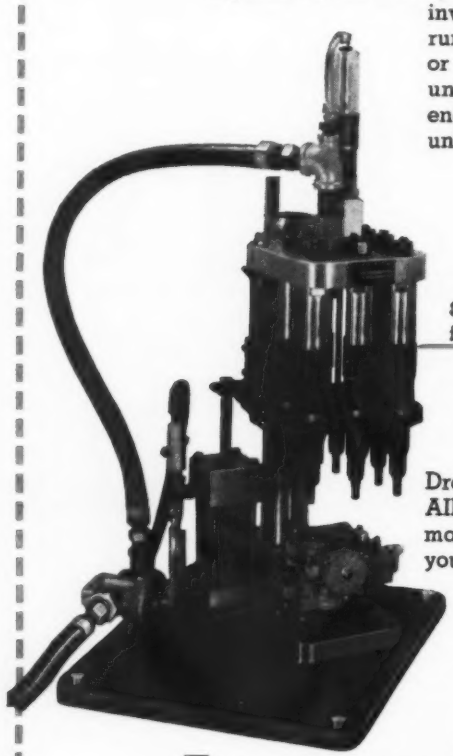
AIRengineering at work
REPORT No. 5098B-3

Multiple Screw Driver
assembles 400
carburetors per hour

Assembling carburetors was a slow, one-screw-at-a-time operation until AIR engineering solved the bottleneck. Now one operator uses this 8-spindle automatic Multiple Screw Driver to help turn out more than 6 completed carburetors per minute—400 every hour.

This compact, easy-to-operate Multiple Screw Driver is just one more example of how AIR engineering is helping modern industry solve problems and cut production time and costs.

All the experience of Ingersoll-Rand in speeding up fastening through AIR engineering multiple units is yours for the asking. Whether your operations involve screw-driving or nut running with either hand-held or automatic production line units, Ingersoll-Rand can engineer and build just the unit best suited to your needs.



8-Spindle Multiple Screw Driver for carburetor assembly.

Drop us a line if you'd like an AIR engineer to analyze and make recommendations on your fastening operations.

Ingersoll-Rand

11 Broadway, New York 4, N.Y.

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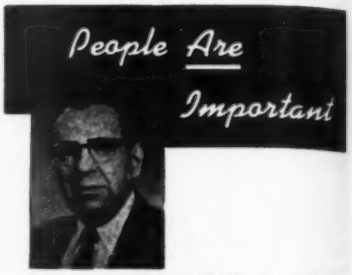


by Erwin K. Taylor, Ph. D.
President
PERSONNEL RESEARCH AND DEVELOPMENT CORP.
Cleveland 20, Ohio

"DOCTOR, HEAL THYSELF"

IN THE OCTOBER ISSUE of TOOLING AND PRODUCTION I sounded-off on the subject of using scientific selection procedures in a tight labor market. One of the points, one of the important points that I made in connection with that discussion, was that the use of a uniform selection procedure could help materially to prevent reducing standards to a point beyond which it was much better to live with a vacancy than to hire a body.

At the time that I wrote that column I was in the process of selecting a new personal secretary. The two young ladies who had worked for me for almost five years had each captured one of my graduate students as husbands. Within a very short period one of them found a job in New York and the other in Cincinnati, and a search for replacements began. In one instance we were extremely fortunate, obtaining a secretary who is loyal, devoted, energetic and competent. She had a friend who was in a position with which she was not completely satisfied, and we were fortunate in inducing her friend to join our staff. These two new employees by virtue of their qualifications and past experience were pre-empted by two of my associates as their personal secretaries.

Then the search for a secretary for me began. We ran ads in the newspapers, contacted agencies and engaged in such other activities as might aid our recruiting efforts. These were surprisingly successful and brought to us a large number of job applicants. We set up a selection procedure, established a test battery and structured personal history and interview requirements.

This took place over a period of three months. In spite of the fact that the other two girls pitched in and did their best to care for my needs in addition to their regular jobs, work piled up.

Psychologists, like the rest of us, are human and as anyone else in a

similar situation, I became increasingly impatient. None of the young ladies we interviewed seemed to have the qualifications that would enable one of them to fit into our organization and function effectively. I became more and more unhappy with the situation and increasingly desperate for someone to empty my outbox, transcribe my correspondence, arrange my appointments and do the hundred and one assorted duties that were necessary.

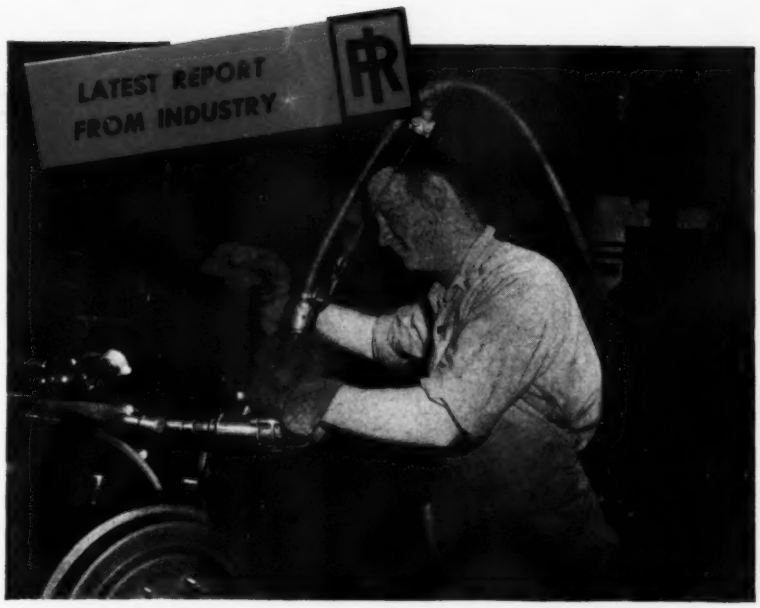
In my desperation I yielded to the human weakness. I began to read into job applicants the qualities we desired, whether they possessed them or not. We continued to interview and test applicants. Sometimes I saw them first, sometimes one of my colleagues did.

One particular applicant was seen by Dr. Nevis first. His report was essentially negative (he thought she would be a tenure risk) but like all good interviewers, he was not ready to trust his own subjective judgment. He suggested, without informing me of the details of his conclusions, that I talk with and evaluate her. My interview impressions were very favorable. She seemed bright, alert and a person with the kind of initiative that I desired in a secretary. True, she had never done work of a nature similar to that which we required and her confessed interests lay in another field. However, her alertness and enthusiasm seemed to be choice assets.

After the interview I looked at her test scores. As I had expected, she was quite a bright person. Actually she was a brighter person than I had hoped to procure for the position and this fact may have helped me to reach an affirmative decision. Yet, her spelling score was bad. This, I rationalized to myself, could be corrected. After all she could use a dictionary. Her typing was below our standard. This I rationalized on the basis of the fact that she had never previously used an electric typewriter.

But worst of all, were the results of the personality tests. She lacked some of the qualities that we had previously determined on the basis of our job analysis to be desirable for the position on hand. Somewhere along the line, too, I carefully overlooked the fact that, while the nature of our work was interesting to us, it might not be to someone else.

In short, we prevailed upon her to accept the position. I briefed her thoroughly on the first morning of employment and then gave her her first assignment. It was a simple letter. The first copy was returned with numerous careless errors. I required her to retype it. The second version was better, but poorly spaced and badly typed. The third version showed some slight improve-



New I-R Torque Control Impactools prove value on auto assembly line

A leading auto manufacturer reports greatly improved *product quality* on 3 auto and truck assembly line operations where Ingersoll-Rand Torsion Bar Torque Control Impactools have been used for 6 months.

A safety hazard is eliminated on one operation, where these new Impactools have made torque control possible for the first time. The photo above shows the I-R Size 5040T Torque Control Impactool securing the steering gear assembly to the truck frame.

Other major benefits include time saving, because these Impactools operate at full power and speed until they automatically shut off when pre-set torque is reached . . . and elimination of the need for hand [illegible] many nut running jobs.

Size 5040T 2 Torsion bars available with max. torques of 60 and 90 ft. lbs.

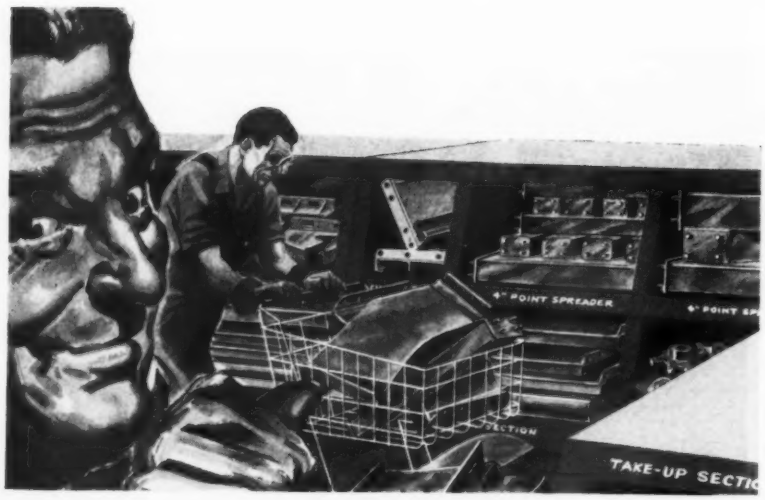
Write for the complete story on this latest I-R development!

Ingersoll-Rand

11 Broadway, New York 4, N.Y.

8-346

CIRCLE INFORM-A-GRAM KEY NO. 93



Now... SUPER MARKET SHOPPING FOR CUSTOMIZED CONVEYORS WITH MAY-FRAN STANDARDIZATION

Developed to provide the ultimate of versatility, the May-Fran program of STANDARDIZATION permits users to create and construct their own conveyors to meet individual needs.

It literally provides a type of "super market" shopping for the straight, curved, inclined, take-up and discharge end sections required to meet the specifications of YOUR job requirements. Sections can be changed relative to length or width with only a minimum of downtime.

Write today . . . ask for MF Bulletin No. 200

MAY-FRAN ENGINEERING, INC.
1726 Clarkstone Road • Cleveland 12, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 94

ment, was passable, but not up to our usual standards.

Moreover, most of our standing operating procedures and carefully communicated policies and relationships were almost studiously avoided by her, probably because she did not find the work interesting. She lasted three days. We then parted on amicable terms, since she is, in spite of her disqualification for our position, a nice person.

As a result of this little episode, we were back right where we started, and she was worse off than if we had not offered her the job.

Like so many of us selecting in a tight labor market, I had allowed myself to become a victim of desperation. As a result, I had wasted a considerable amount of my valuable time, three days of pay, and had experienced an ego deflating process. Reenforced by this unhappy experience, we resumed the search and found a young lady who is eminently qualified

This personal experience of mine may be akin to one you have had or will have . . . not necessarily with a secretary, perhaps a junior executive. a setup man, an inspector. But, I will not make this same mistake again. Will you?

—•—

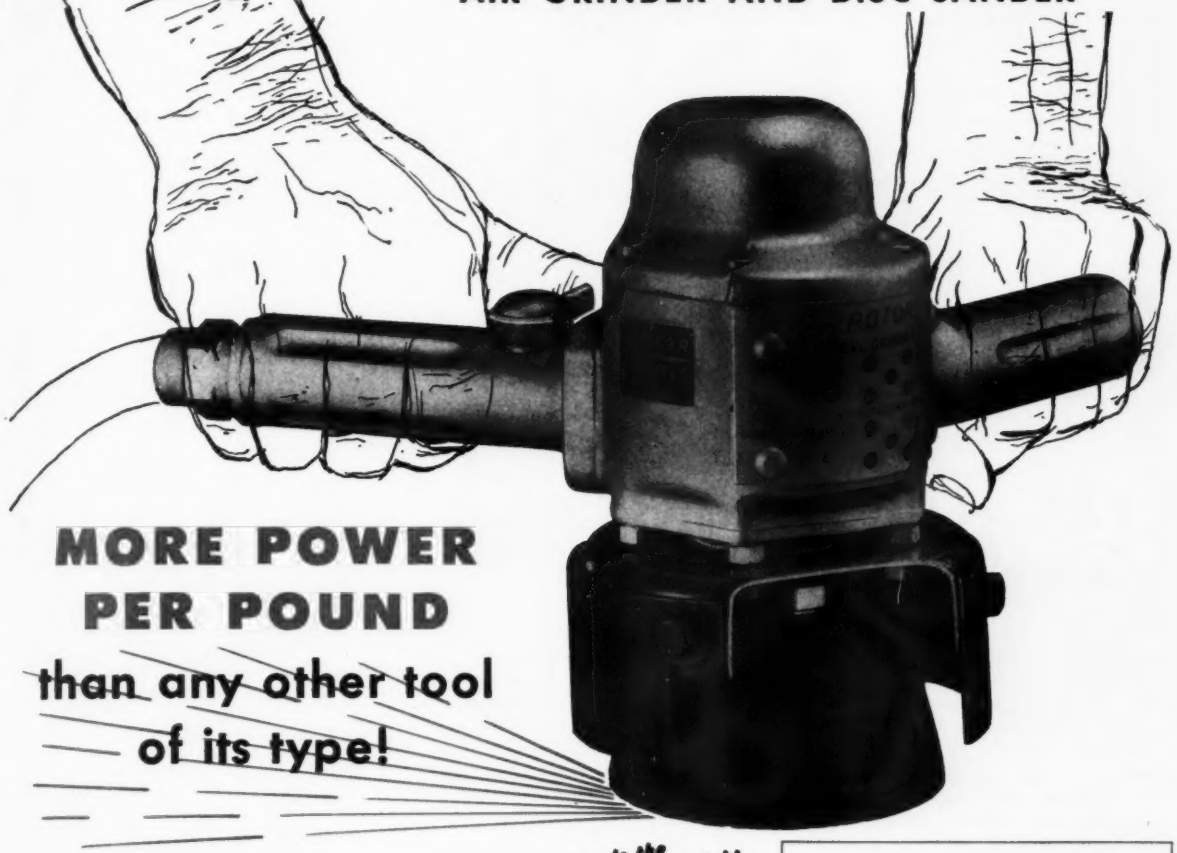
LONG-DIE SWAGING MACHINE TAPERS TUBULAR LEGS

A newly developed long-die swaging machine is rapidly gaining popularity in the tubular steel furniture industry. This machine, built by The Fenn Manufacturing Company of Newington, Conn., is capable of taking a 16" long taper in a single pass. Thus, it is possible for manufacturers to produce finished, modern tapered furniture legs at the rate of 3/min from a variety of tubular materials including stainless steel and aluminum.

The special long dies, the heart of the swager, measure 2¼" x 1-19/32" x 15" and are made to the highest standards of precision under strict quality control supervision during every step of manufacture. Die tolerances are such that die halves may be interchanged and still produce a quality product. The use of the long-die swager means an effective shortening of production time because of increased operation speed. Also, scrap costs are eliminated because swaging shapes metal by displacement rather than by removal.

NEW! THE ROTOR B-7 VERTICAL

AIR GRINDER AND DISC SANDER



MORE POWER PER POUND

than any other tool of its type!

FOR sanding, cup wheel grinding, wire brushing, cut-off work.

FEATURES. Light weight... easy to handle. Positive, direct-acting governor... less maintenance, safer. Dead handle can be removed for fast, one-handed operation on "feathering" jobs.

Available with two types of handles... straight (shown above) or safety (shown at right).

Has automatic built-in oiler.

ASK FOR CATALOG 47

Here's the featherweight with the heavyweight punch.

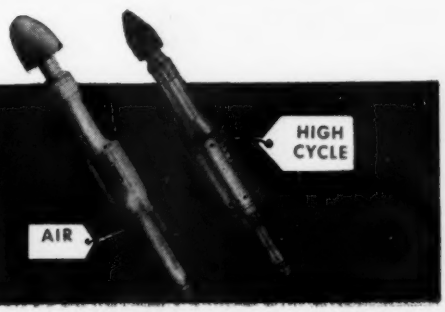
SPECIFICATIONS

WEIGHT 6¾ lbs.
HEIGHT 7 inches overall
SPEEDS 8000, 6000 or 4500 rpm.

MODELS

B-7S (Straight Handle)
B-7SS
(Safety Straight Handle)

THE ROTOR TOOL CO.
CLEVELAND, OHIO



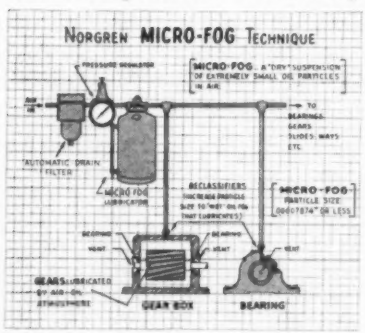
CIRCLE INFORM-A-GRAM KEY NO. 95

1 QT. of OIL Lubricates Machine Completely for 90 HOURS

One Norgren MICRO-FOG Lubricator automatically coats all the gears and universal joints on the Moline Drilling Machine, above, with a continuous protective film of fresh oil. Just the right amount of oil—⅓ oz. per hour—no more, no less—is applied to provide the most efficient lubrication, holding machine wear to a minimum.

What Is Norgren MICRO-FOG?

Norgren MICRO-FOG is an airborne suspension of extremely small oil particles (.00007874" or less in diameter). Because the oil particles are so small, they can be conveyed long distances through complex piping systems without reclassifying and flooding the lines with oil—a condition formerly not possible with conventional oil-fog systems.


NORGREN MICRO-FOG TECHNIQUE
MICRO-FOG, A "DRY" SUSPENSION OF EXTREMELY SMALL OIL PARTICLES IN AIR
TO BEARINGS, GEARS, SLIDES, WAYS, ETC
"AUTOMATIC DRAIN" FILTER
RECLASSIFIERS
MICRO-FOG PARTICLE SIZE .00007874" OR LESS
GEARS LUBRICATED BY MICRO-FOG ATMOSPHERE
GEAR BOX
BEARING

Now—MICRO-FOG For 32, 200, 300, 1000 Bearing-inch Requirements

The MICRO-FOG Lubricator on the Moline Drilling Machine, above, has the capacity to lubricate up to 200 bearing-inches. Other MICRO-FOG Units are available with lubricating capacities of 32, 300 and 1000 bearing-inches—the most complete line of aerosol lubricators. This wide range of lubricating capacities means that you can select a Norgren lubricator with exactly the right capacity for the most efficient, complete, machine lubrication.

Without obligation, learn how Norgren MICRO-FOG can simplify design, reduce costs, and improve machine performance. Call your nearby Norgren Representative listed in your telephone directory — or **WRITE THE FACTORY FOR NEW CATALOG.**

C. A. Norgren CO

3449 SO. ELATI ST., ENGLEWOOD, COLORADO

Pioneer and Leader in Oil-Fog Lubrication Since 1930

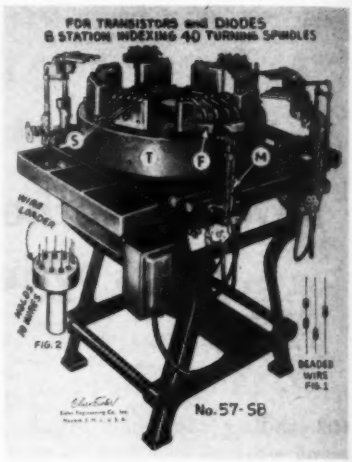
CIRCLE INFORM-A-GRAM KEY NO. 96

Melting Glass Beads onto Wire

A machine of improved design has been developed for melting glass beads onto wire, items of which are in great demand in the fabrication of diodes, radio tubes, and other electronic devices.

The machine, built by the Eisler Engineering Co., Inc., 732 So. 13th St., Newark 3, N. J., has many productive features such as:

1. A turret (T) indexes intermittently by means of an 8-station Geneva gear located on the underside of the turret.
2. Each of the 8 stations of this machine consists of a nest of 5 rotating spindles (S). In addition to this each rotary spindle accommodates 5 wires in the beading operation. This combination has a productivity of 25,000 wires/hr when the machine is operated at a speed of 500 indexes/hr.



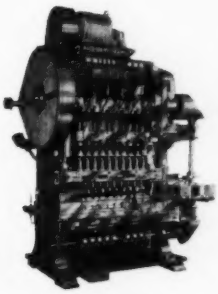
3. The gas burners (F) using gas and air, provide the proper heat for melting the glass to the wire. Micrometer adjustment (M) makes possible accurate adjustment of the gas burner flames. The gas burner system has been developed for use with manufactured gas, and low pressure air, but can be modified to use natural gas as well as bottled gas.
4. Figure 2 of the illustration shows the rotary spindles which are preloaded.

The operator places the pre-loaded spindles on the machine and removes those spindles which have been processed.

One operator is required at the machine. A variety of beaded wires is shown in Figure 1.

For **Automation** In Pressworking
THINK OF WATERBURY FARREL

"Waterbury" Transfer Presses



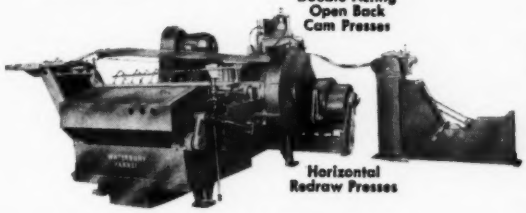
Cam and Crank Eyelet Machines

Four Post Blanking Presses

High Speed Blankers

Double Acting Open Back Cam Presses

Single Acting Open Back Bench Presses



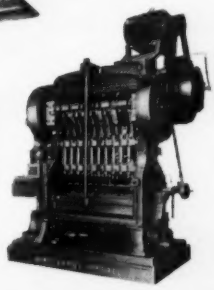
Horizontal Redraw Presses

Waterbury Farrel's extraordinary range of press-building experience encompasses a wide variety of single and multiple operation presses. These include virtually every commercial type up to 600 ton capacity.
In addition, Waterbury Farrel has successfully engineered automated press output by combining presses, feeds, hoppers, straighteners, coil holders, scrap choppers, scrap winders, finger motions, attachments for side piercing, blank turning, stripper release, and blank holding mechanisms into production-team units.

Write for free catalogs on specific types of presses or contact your nearest Waterbury Farrel office today.

THE WATERBURY FARREL FOUNDRY & MACHINE CO. Waterbury, Conn.
Sales Offices: Chicago • Cleveland • Millburn, N. J.

Inclined Shell Threaders



Multiple Plunger Pillar Presses

COLLAPSIBLE TUBE EQUIPMENT
Knuckle Joint Presses
Tube Cap Machinery
Tube Trimming Lathes

HIGH SPEED PRESSES
Two Post Blanking
Four Post Blanking

MULTIPLE STATION MACHINES
Cam Eyelet
Crank Eyelet
Multiple Plunger
Pillar Presses
Transfer Presses
Horizontal
Redraw Presses

OPEN BACK PRESSES
Double Acting Cam
Double Acting Crank
Geared
Single Acting Crank

PILLAR PRESSES
Double Acting Cam
Double Acting Crank
Geared Pillar
Single Acting Crank

SMALL PRESSES
Foot
Hand
Safety Bench
Single Acting
Open Back Bench

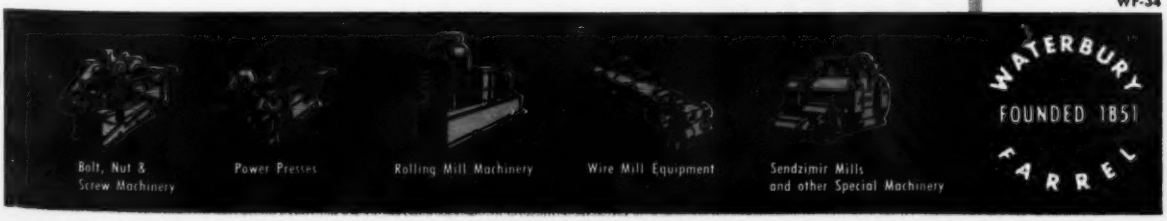
SINGLE AND DOUBLE GEARED ARCH DRAWING PRESSES
THREADERS
Inclined Shell Threaders
Screw Cap Thread Rolling Machines

MINT COINING PRESSES
LATHES
Edging, Trimming and Knurling Lathes

AMMUNITION AND CARTRIDGE MACHINERY
Arbor Lathes

MISCELLANEOUS
Coil Holders
Coil Holders and Roll Straightener Units
Roll Straighteners
Unwinding Device
Gang Slitters

WF-34



CIRCLE INFORM-A-GRAM KEY NO. 97

INDEX short or long runs on a production basis

with Hartford Special SUPER-SPACERS

- Quick, easy setups without expensive jigs or fixtures.
- Positive, rapid indexing accuracy in a minimum of .00116" on a 4" radius, noncumulative.
- Super-Spacer can be indexed visually to any degree setting with Vernier accuracy and locked in position.

12" SUPER-SPACER

Length overall:	16"
Width overall:	12½"
Base to chuck face:	6 1/32"
Width of keys:	1/16"
Thru hole diameter:	4"
Chucking diameter:	½" thru 12½" O.D.
Weight:	190 lbs.

Mask plates for divisions from 2 through 27 are available from stock. 2, 3, 4, 6, 8, 12, 16 and 24 notch plates are furnished with the standard unit. Special mask plates for unequal spacing made to order. 48 notch master index plate furnished with standard unit. Special master index plates for 27 through 54 divisions carried in stock. Special index plates for unequal spacing made to order.

8" SUPER-SPACER

Length overall:	12⅛"
Width overall:	10⅛"
Base to chuck face:	6 3/64"
Width of Keys:	1/16"
Thru hole diameter:	2½"
Chucking capacity:	⅛" thru 8" O.D.
Weight:	110 lbs.

Mask plates for divisions from 2 through 18 are available from stock. 2, 3, 4, 6, 8 and 12 notch plates are furnished with the standard unit. Special mask plates for unequal spacing made to order. 24 notch master index plate furnished with standard unit. Special master index plates for 16 through 36 divisions carried in stock. Special index plates for unequal spacing made to order.

HARTFORD *Special*

Thousands of users the world over proclaim Hartford Special Super-Spacer The Standard of Indexing Devices for —

Milling	Boring	Inspecting
Drilling	Slotting	and other
Tapping	Planing	Machining Operations

A complete line of accessories available. See the Hartford representative in your area or write for Bulletin S-104.

MACHINE TOOL ACCESSORIES DIVISION
THE HARTFORD SPECIAL MACHINERY CO.
29211 HOMESTEAD AVENUE HARTFORD 12, CONN.

"Commendable Comments"

"Assuming that diversification can begin at home, a detailed check-up of your own plant's facilities and equipment is an essential first step . . . ideally a good new product is one that can be turned out profitably with minimum expansion of labor force and without disproportionately high investment in new tooling. A careful analysis of existing tooling should be made to determine exactly its present and potential capabilities."

—From a talk by Thomas R. Rudel, President of the Rudel Machinery Co., at the Eastern Plant Management Conference of the National Metal Trades Association.

"Proper preliminary planning, selection of equipment to serve the end results, and careful timing can have some far reaching effects on the senior officer's functions. This is true not only in all large organizations but also in many of medium size and some quite small."

—Comments by Gordon L. Mattson, Management Consultant and Director of the Office Automation Conference.

"What is the use of continuing this ruinous (government) stockpiling when all our top military experts agree that any major future war could only be a 48-hour — or, at the most, a 30-day —conflict fought only with the weapons on hand? Thus stockpiling for national security has deteriorated from its original intent, and its appropriations are being used now to provide vast national and international political subsidies."

—Remarks by Col. Willard F. Rockwell, board chairman of Rockwell Manufacturing Co. and Rockwell Spring & Axle Co. at a meeting of the Pittsburgh chapter, American Foundrymen's Society.

"Management is improving things through other people. . . . If management does not continue to improve products, prices, production and profits management will reach a plateau. This will mean management has stopped learning and stopped growing."

—Comments by George G. Raymond, President of The Materials Handling Institute, Inc., and The Raymond Corp., at an Ohio Packaging and Material Handling meeting.

". . . steel customers can help a lot toward smoothing out steel cycles by gearing their purchases more closely to their actual consumption needs. In the postwar period, steel buying has tended to run ahead of actual consumption in periods of high business activity and to fall behind consumption in periods of declining business. This has been in the chief cause of instability in steel demand in recent years."

—Remarks by J. L. Mauthe, President, The Youngstown Sheet & Tube Co., at the Association of Iron & Steel Engineers' Convention.

NOW . . .

AVAILABLE FROM STOCK

Jarvis PIPE TAPS WITH STANDARD HAND TAP SHANKS!

Here's the answer to the problems presented by conventional pipe taps! Exclusive Jarvis Pipe Taps with standard hand tap shanks easily fit any tapping machine or device—with never a chucking bottleneck. This addition to the dependable Jarvis line of standard taps affords new tapping versatility and precision.

Send Today for Catalog!

Here's the big advantage of Jarvis taps with Standard Hand Tap Shanks—

	¼"—18 N P T Standard Pipe Tap	¼"—18 N P T New Jarvis Pipe Tap
Shank dia.	.5625	.480
Square size	.421	.360
Overall lgth.	2⅞"	3⅛"

Three other sizes are stocked—⅛", ⅜", ½"—and all save man-hours, production dollars.

A Jarvis representative is as near as your phone.

Complete manual with tap data and tips for better tapping is yours for the asking!

Jarvis CORPORATION

POWER TOOLS FOR INDUSTRY

MIDDLETOWN CONNECTICUT

CIRCLE INFORM-A-GRAM KEY NO. 99

Announcing . . .

METLFAX

METLFAX: a new, unique publication!

METLFAX: devoted exclusively to serving the metalworking industry!

METLFAX: first issue — November 1956!

METLFAX: a pocket-size 4¼" x 6" review publication devoted exclusively to metalworking PEOPLE • PLANTS • PRODUCTS • PROCESSES • PRODUCTION!

METLFAX: a pocket-full of metalworking information! Designed for redi-readability!

METLFAX: written to command the interest of design, engineering, tooling, production and management executives at all levels and in every phase of metalworking!

METLFAX: aims and objectives — to aid the entire metalworking industry in achieving maximum production at minimum costs!

METLFAX: capsule comments on all metalworking subjects, providing a previously non-existent coverage of the entire metalworking market!

METLFAX: over 75,000 copies! An initial controlled-circulation to more than 75,000 metalworking executives, by name and title, in every size and type of metalworking plant throughout the nation! Circulation list over four years in the making — 100% up-to-date!

METLFAX: offers the lowest per thousand full-page rate for reaching the entire metalworking field! Maximum metalworking coverage at an unbelievable low cost of less than $4.00 per page per thousand copies!

Closing date for the January issue is December 1, 1956. For full information, rates and details, address . . .

METLFAX

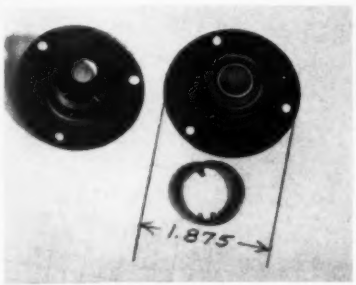
1975 Lee Road

Cleveland 18, Ohio

AUTOMATIC MACHINE PRODUCES 1,440 ASSEMBLIES HOURLY

Automotive window lift assembly components are fed, positioned, assembled and unloaded, without an operator, on a newly designed automatic assembly machine.

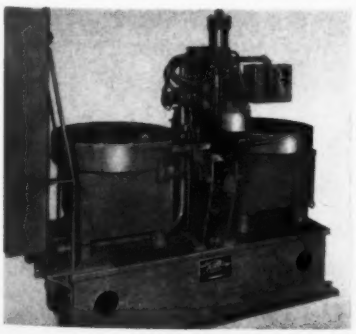
The assembly consists of two pieces, a coil spring and a stamped housing. A hook on the spring end must be oriented in proper relation to pierced holes in the housing flange. The housings are fed from a hopper at one side of the machine, whiie the springs are fed from a hopper at the opposite side. Vibratory feeders are used for both parts.



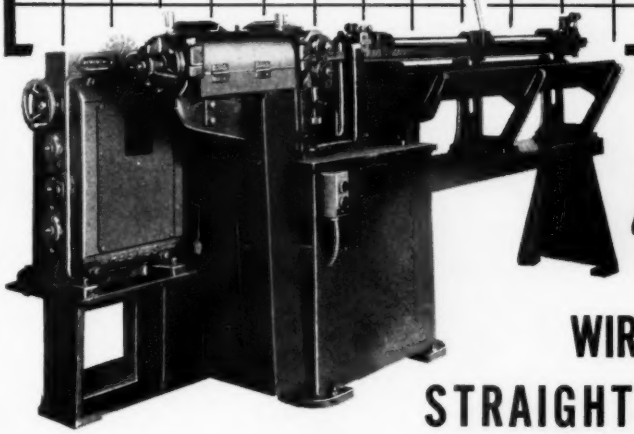
Each housing is positioned with the open side up. A spring feeds over it, where the spring is compressed and pressed into place by sliding "V" members. The assembly is then shuttled under a ram which enters the coil with a locator that prevents the spring from turning. A locating device picks up the locating holes and rotates the housing until the spring end is properly oriented in relation to the holes.

Pressing in and orienting of the spring are done simultaneously, and the same slide that pushes the assembly under the orienting device automatically unloads finished assemblies.

In addition to completely automatic operation, the machine, built by Omer E. Robbins Company, 24800 Plymouth Rd., Detroit 9, features automatic lubrication, hardened and ground ways, and all electrical and pneumatic equipment in conformance with J.I.C. standards.



NEW! SHUSTER LIGHTNING CUT-OFF PRODUCTION BOOSTER



1AV

WIRE STRAIGHTENING AND CUTTING MACHINE

DESIGN ADVANTAGES

Micro-switch target and clutch

Lightning cut-off

Hardened steel cut-off knife delivers square, true, undistorted ends.

Direct-drive five-die straightening flier

Ball and roller bearings throughout

Other infinite variable speed machines for diameters up to 11/16" are available. Send for literature.

NOW EQUIPPED WITH ELECTRICALLY CONTROLLED TARGET AND CLUTCH!

Variable Speed — the speed you want when you want it. Geared to feed 50 to 200 feet per minute.

Constant Speed when set, regardless of load variations!

Infinite feed changes and control!

Minimum maintenance — frees operator from worry!

Straightens and cuts 3/32" to 1/4" **or** 1/16" to 3/16" diameter basic wire — real production flexibility!

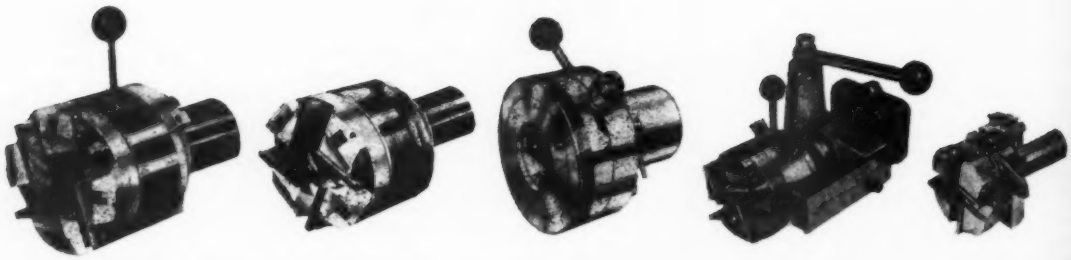
Most economical machine of its kind! — both in original cost and maintenance!

Send for Bulletin No. 53

METTLER MACHINE TOOL, INC.

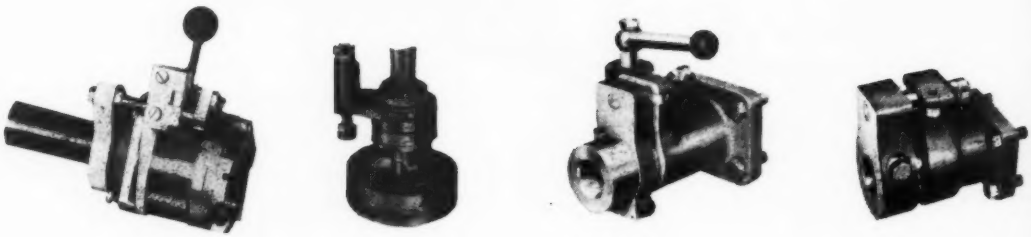
150 Adeline St. New Haven, Conn.

CIRCLE INFORM-A-GRAM KEY NO. 101

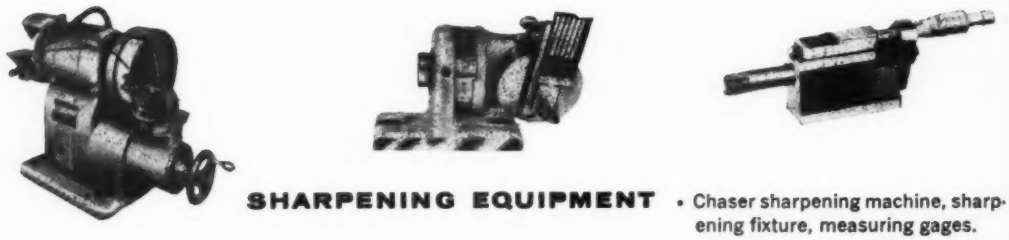


DIE HEADS • Automatic opening tangent stationary and revolving types, tangent taper receding, radial stationary, hollow milling, B&S and small turret lathe types.

Jones & Lamson's thread



ACCESSORIES • External and internal trip attachments, drill press adapters, floating holders.



SHARPENING EQUIPMENT • Chaser sharpening machine, sharpening fixture, measuring gages.

Class III threads guaranteed . . . every time!

JONES & LAMSON

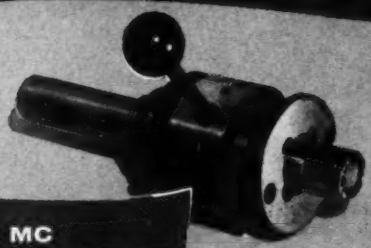
JONES & LAMSON MACHINE COMPANY, 519 CLINTON ST., SPRINGFIELD, VT. U. S. A.

Jones & Lamson recently purchased the Modern Tool Works, Rochester, N. Y. This acquisition greatly broadens J&L's service in the thread tool field, by integrating the products and designs of both companies.

Now, J&L, operators of the world's most modern thread tool plant, offers you its own complete lines of die heads and chasers, accessories and sharpening equipment, plus a line of collapsible taps and chasers, solid adjustable taps and chasers, the Modern-Magic Chuck, and the Modern Stud Setter. Complete engineering service is also offered for the entire new combined line of products.

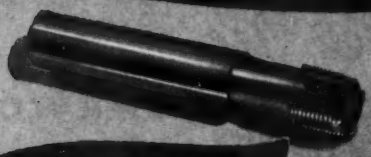
Send today for complete literature.

tool line now includes . . .



J&L MC COLLAPSIBLE TAPS

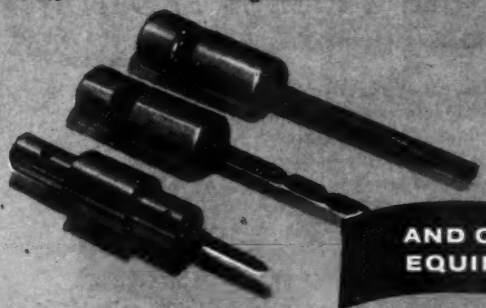
The same tap may be used on either stationary or rotating jobs. One complete tap, plus parts, gives you five sizes of taps ranging from 1 5/16" to 3½".



J&L MS SOLID ADJUSTABLE TAPS

With ground-thread, precision chasers. Chasers can be removed from tap, reground and reset to cut to original size.

MODERN-MAGIC CHUCKS . . .



AND COLLET EQUIPMENT

Positive or adjustable friction drive for horizontal or vertical use. MODERN-MAGIC Quick Change Chucks and Collet Equipment virtually eliminate costly idle time of revolving spindles. Using these chucks, tools can be changed without stopping or even slowing the spindle. They give multiple spindle range to single-spindle machines. For instance: you can change collets as fast as you can index a turret.

J&L STUD SETTERS

The new Style M Self-Opening Stud Setter's four-ball drive clutch gives more positive disengagement for more accurate stud heights.

MACHINE COMPANY

THREAD TOOL DIVISION

CIRCLE INFORM-A-GRAM KEY NO. 103

You Can be Sure of
2 WAY BENEFITS
PRODUCTION PROFITS
When You Use
DPS POWER SCREWDRIVERS
and other Assembling Equipment

Present Owners Report a SHARP GAIN in OUTPUT and a RISE in PROFITS!

Important Reasons why you, too, should benefit from greatly stepped-up, lower-cost production and the wider profit margin that naturally follows . . . These 2-way advantages of DPS Power Methods have been proved in over a quarter century of service to modern industry . . . If you are still using out-moded assembling methods, change now . . . Get the facts about the extensive DPS line. No doubt we have a product that can be adapted to your requirements. Write today.

BARREL FEEDER
with stationary ring cover, for heavy-duty, large production runs

BOWL FEEDER
Vibratory type, to select and feed smaller fragile parts

DPS SELECTIVE PARTS FEEDERS

Modern Necessities Widely Adaptable

These versatile devices not only provide the feeding operations on Detroit Power Screwdrivers, but they are being widely used on today's many special high-production machines.

5 SCREW-DRIVING MACHINES
Bench and Pedestal types. Pedestal Model A pictured

WHAT IS YOUR FEEDING AND ASSEMBLING PROBLEM? WRITE US—ALSO SEND SAMPLE ASSEMBLY

DETROIT POWER SCREWDRIVER CO.
2827 W. FORT ST. DETROIT 16, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 104

ENGINEERING FORMULAS AND TABLES. Published by Lefax Publishers, Philadelphia 7, Pa., 350 pages, $2.75.

Mechanical, electrical and civil engineers will find this newly revised pocket-size book of basic formulas, design data and tables an indispensable tool. Condensed, indexed and mathematically accurate, 12 division sheets with printed tabs furnish immediate access to the particular information desired. Sections include Mathematics, Measures, Materials, Gauges, Screws, Mechanics, Electricity and Magnetism, Hydraulics, Structural Data, Reinforced Concrete, Pipe and Fittings, Steam Tables and Mathematical Tables. This new data book is the result of 40 years of compilation, condensation and revision.

HANDBOOK OF WELDED STEEL TUBING, Revised January 1956. Published by the Formed Steel Tube Institute, Inc., Cleveland 15, Ohio, 1956. $10.

Unlike previous editions, the latest handbook is divided into two distinctly separate sections, one on welded carbon steel tubing and the other on welded stainless steel tubing.

All types of information pertaining to general processes, mechanical properties, fabrication methods and applications for both carbon and stainless tubing are included. A special section contains design data and a glossary of terms for welded steel tubing.

DIRECTORY OF NEW ENGLAND MANUFACTURERS, 1957 Edition. Published by George D. Hall Co., 20 Kilby St., Boston 9, Mass., with the editorial cooperation of The New England Council. 776 pages, $40.

The complete picture of manufacturing in New England is contained in this one volume, as an aid to selling, buying and helping companies do business more profitably in New England. It lists 13,000 manufacturers, 25,000 ranking executives, 3,000 products and services, and 3,700 brand names. Manufacturers are listed alphabetically, geographically (by state, city or town), by products manufactured and by brand names.

100 to 1 . . . it's a Jacobs CHUCK

Jacobs and your industrial supply distributor are ready to deliver the chucks you need and the service you deserve. First in chucks . . . first in service.

THE JACOBS MANUFACTURING COMPANY • WEST HARTFORD, CONN.

The Jacobs Model 91 Spindle Nose Collet Chuck for tool room and engine lathes.

The Jacobs Rubber-Flex® Tap Chuck for tapping heads and impact tools.

The Jacobs Plain Bearing Chuck for drill presses, portable electric and air tools.

The Jacobs Ball Bearing Super Chuck for heavy duty and precision industrial use.

The Jacobs Model 96 Collet Chuck for grinding machines, millers and jig-borers.

The Jacobs Impact Keyless Chuck especially designed for the aircraft industry.

Now! Closer gage block tolerances give you up to 75% longer wear life at no increase in price!

Ellstrom Standards are now produced and unconditionally guaranteed to specified millionths well within the following improved gage block tolerances:

"W" Working Accuracy Blocks: +.000008", −.000002" per inch of length, with flatness and parallelism held within .000006".

"I" Inspection Accuracy Blocks: +.000004", −.000002" per inch of length, with flatness and parallelism held within .000004".

In addition to providing finer accuracy at no increase in price, these Ellstrom Standards also give you up to 75% longer wear life. For, by reducing the allowable "minus" deviation, you get an additional guaranteed wear allowance of from 2 to 6 millionths of an inch, as compared to common industry standards, before the blocks need be considered worn undersize.

Ellstrom Standards are furnished in 28 basic sets of from 8 to 92 blocks in both rectangular and square styles. Individual blocks are also available in sizes ranging from .010" to and including 20.000" to meet your particular needs. Send for complete specifications and prices today!

Set No. 35-R: "W"—$195.80; "I"—$280.50

Set No. 81-SA: "W"—$545.60; "I"—$764.35

ELLSTROM STANDARDS DIVISION
DEARBORN GAGE COMPANY
"Measuring in Millionths for Three Generations"
22038 Beech Street • Dearborn, Michigan

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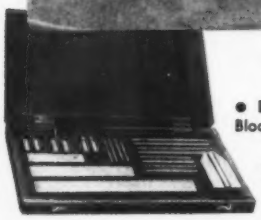
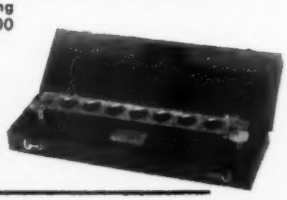


- Ellstrom Internal Setting Gage—12" range: $185.00
- Ellstrom Rectangular Gage Block Accessory Set: $288.95
- Ellstrom Master Sine Bar "W" Accuracy: $112.50 "I" Accuracy: $152.75



CIRCLE INFORM-A-GRAM KEY NO. 106

MANAGEMENT IN ACTION, by Lawrence A. Appley. Published by the American Management Association, 1515 Broadway, New York 36, N. Y., 1956. 382 pages, $5.

In this real how-to-do-it book, the author has applied the experience of the operating executive and the knowledge and insight of the social scientist to arrive at answers that are significant to everyone who "gets things done through people."

The focus is on man, his relations with the group in which he functions and with himself as well. Each section on different important aspects of executive action provides practical suggestions to the reader. There is a great deal said about authority, management responsibility, employee morale, executive appraisal, and related matters.

HOW TO GET INDUSTRIAL AND BUSINESS PUBLICITY, by Charles E. St. Thomas. Published by Chilton Co., Philadelphia 39, Pa., 1956. $5.

Most important feature of this book is its complete step-by-step treatment of what any firm must do to get efficient and effective publicity. How to Organize for Publicity, Forms and Working Procedures, How to Release Publicity, Personal Contact with the Press, Measuring and Reporting Publicity, Relationship of Publicity to Advertising and Sales, are some of the helpful chapters.

The book should prove to be a primary reference for both management and those in the publicity business.

INDUSTRIAL ENGINEERING HANDBOOK, Harold B. Maynard, Editor-in-Chief. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y., 1956. 1,504 pages, $17.50.

A broad, authoritative treatment of the wide field of industrial engineering is contained in this handbook of principles, data, methods and procedures. Experts from many related fields have contributed sections on such divers topics as the industrial engineering function, work measurement, predetermined elemental time standards, wage payments, plant facilities and design and control procedures.

Factual in approach, the book covers many practices, from such long-accepted techniques as time and motion study to such developments as automation and linear programming. Procedures used directly by the industrial engineer, and related ones such as quality control and tool and gage design, are covered.

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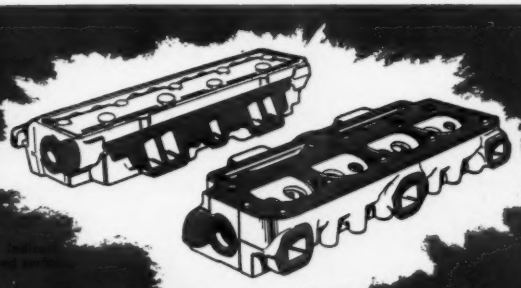

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Kearney & Trecker built this 12-Station Automatic Transfer machine which rough and finish mills the head gasket surfaces, mills intake and exhaust port surfaces and both ends, and drills, counterdrills and reams two holes on each of two cylinder heads for V-8 engines. Machine's production rate is 100 pieces per hour.

The two cylinder heads progress automatically through the machine side by side, each on separate transfer rails. Transferring, locating, clamping, lubrication and chip disposal are all automatic.

For more information on machine illustrated, ask for Data Sheet No. 1080. A new bulletin, SMD-56, which describes many of our outstanding designs, is also yours for the asking.

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Take advantage of our abilities. They can pay off in profits for you. See or write your Kearney & Trecker Special Machinery Division representative. He will be pleased to give you all the details on this production machine. Contact him today!

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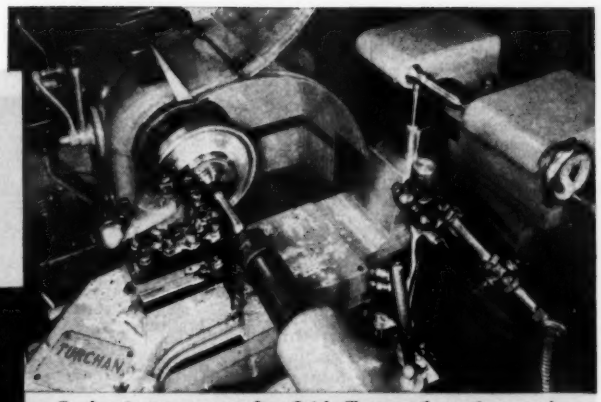
Turchan HYDRAULIC TRACER CONTROLS

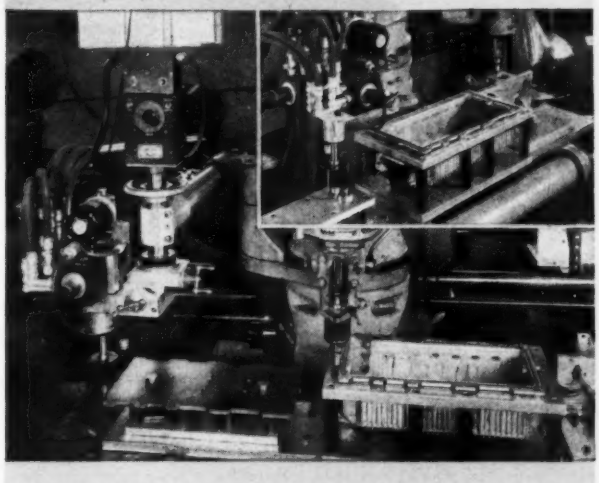
THE SIMPLEST SYSTEM OF MORE PROFITABLE PRODUCTION



Turchan tracers assure a finer finish. The smooth, continuous advance of the carriage by power feed, coupled with the floating action of the angular tool slide, produces a turned surface of unsurpassed smoothness. In many instances final grinding is unnecessary.

TURNING
MILLING
BORING
PLANING
SHAPING

Machine tools equipped with Turchan tracer controls handle a greater variety of work faster and more accurately. Standard operation of the machine is possible by a simple switching mechanism which converts the machine quickly from straight work to intricate profiling and contouring and back again.



Complicated work requiring contouring, grooving and profiling are handled easily with Turchan Tracer control. In most cases many extra operations are reduced to one set-up.

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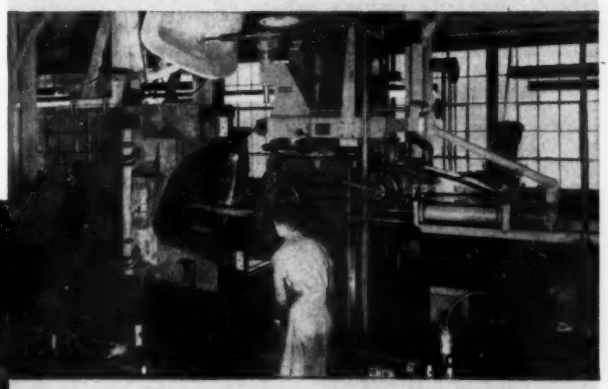
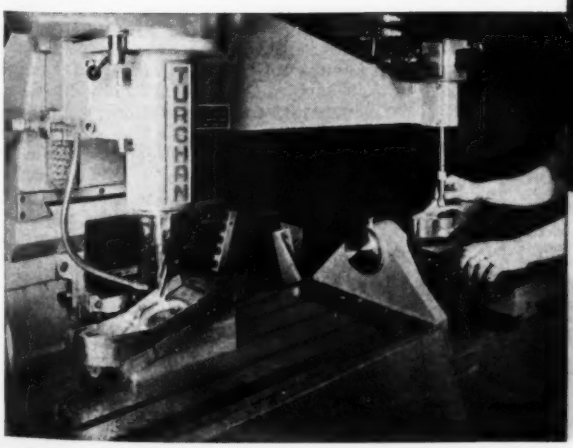
FOLLOWER MACHINE CO.
8259 LIVERNOIS • DETROIT 4, MICH.





Turchan units are supplied complete. Installation is very simple and all installations are supervised by a Turchan engineer.

Write today for your Turchan Folders. If you have a production problem Turchan has the solution.

CIRCLE INFORM-A-GRAM KEY NO. 109

WESSON INTRODUCES "NO-GRIND" CUTTERS

A new series of "No-Grind" milling cutters has been designed for use of low cost indexable throw-away Wessonmetal carbide inserts with commercial-ground thickness tolerances.

These cutters feature a single locking mechanism with only two parts — a wedge and a screw, elimination of any projections including screw heads, and accurate insert location. They use low-cost standard throw-away inserts rather than special inserts ground to gage-like tolerances.

The 7° axial and radial rake are automatically provided by the blade slot and each insert can be indexed to each of its eight cutting edges before being discarded. No blade adjustment is required when indexing.

For details on the "No-Grind" milling cutters, contact Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich., or —

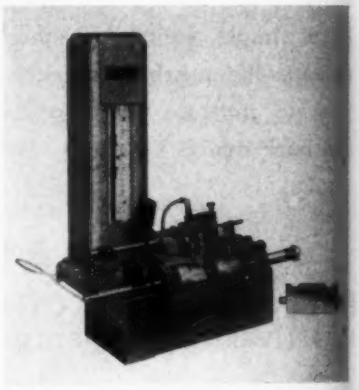
Circle Inform-A-Gram No. D1.

SPEEDY, ACCURATE CAM INSPECTION

The 3D Comparitor produced by Parker Stamp Works Inc., gives readings on both two and three dimensional cams that are accurate to tolerances of ±0.0002". However, measurements of ±0.0001" are possible on highest precision work.

This new concept of cam inspection affords an absolute check of an infinite number of stations ten times faster than conventional methods. It makes possible the complete, 100% comparison on 50 to 60 two or three dimensional cams per day.

An intricate three dimensional cam with 4000 stations formerly required a full work week for inspection. The 3D Comparitor performs the same work in less than four minutes.



The 3D Comparitor gives true readings on an infinite number of specified points — one, one hundred or one hundred million. In addition, it also measures an infinite number of points between stations, compared with a master.

Incorporating a regular Sheffield air gage, with Plunjet, this comparitor uses a ball probe to trace the contours of work. The master and duplicate cam are installed on a single arbor. As both pieces revolve, any discrepancy of dimensions is indicated on the air gage.

For complete information on the 3D Comparitor, contact Parker Stamp Works Inc., 650 Franklin Ave., Hartford, Conn., or —

Circle Inform-A-Gram No. D2.

All gaging authorities agree that it is necessary to gage to an accuracy 10 TIMES GREATER than the desired working tolerance. Therefore, if your tolerances are .0005" or less, you should use a gage accurate to 50 millionths of an inch to assure proper dimensional control. Conventional mechanical indicators cannot maintain, or repeat this degree of accuracy.

Industry is finding the electronic indicator not only more accurate and repeatable, but also less subject to damage than conventional mechanical indicators. In addition, its simplicity of operation enables any operator, who can use a dial indicator or micrometer properly, to measure accurately to millionths of an inch.

Simple And Easy To Read To MILLIONTHS OF AN INCH . . .

The INDI-AC ELECTRONIC INDICATOR is merely set to the required dimension with standard gage blocks. The parts to be gaged are then placed under the gage tip and the meter indicates the variations from the desired dimension MAGNIFIED UP TO 10,000 TIMES! Thus it is far simpler and easier to read than a dial indicator or micrometer.

This versatile instrument is used for all gaging purposes such as surface plate or height gage work, checking setups, runout or alignment of parts or machines.

Using the INDI-AC, the tolerances which you now estimate will be easy to work to and measure.

WRITE for further details on the *new* INDI-AC and other Electronic Production Gages, TODAY!

Cleveland INSTRUMENT COMPANY, INC.
738 Carnegie Avenue • Cleveland 15, Ohio

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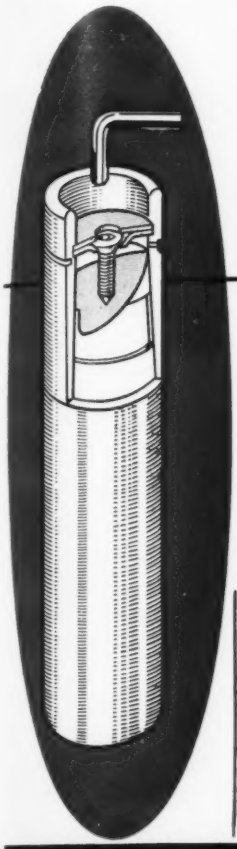
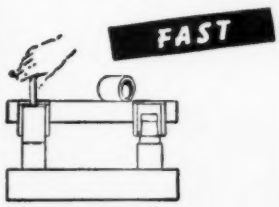


No DIE SET PARTING PROBLEMS

WITH SUPERIOR REMOVABLE CAP GUIDE PINS

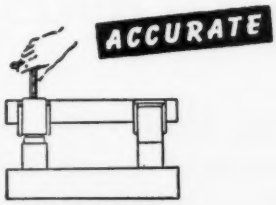
NOW on every Superior die set in diameters from 1½" upward at no additional cost

Superior's Removable Cap Guide Pins eliminate punch holder binding on guide posts when parting dies. The cap is removed from the pin merely by loosening a socket head screw which holds the cap in place. This frees the punch holder at the most critical point of the pin where it is apt to cock or bind. Instead of needing 2 or 3 die makers to remove the punch holder from a set, one man can easily do this work alone in a few minutes.



REMOVING CAP

PARTING DIE SET



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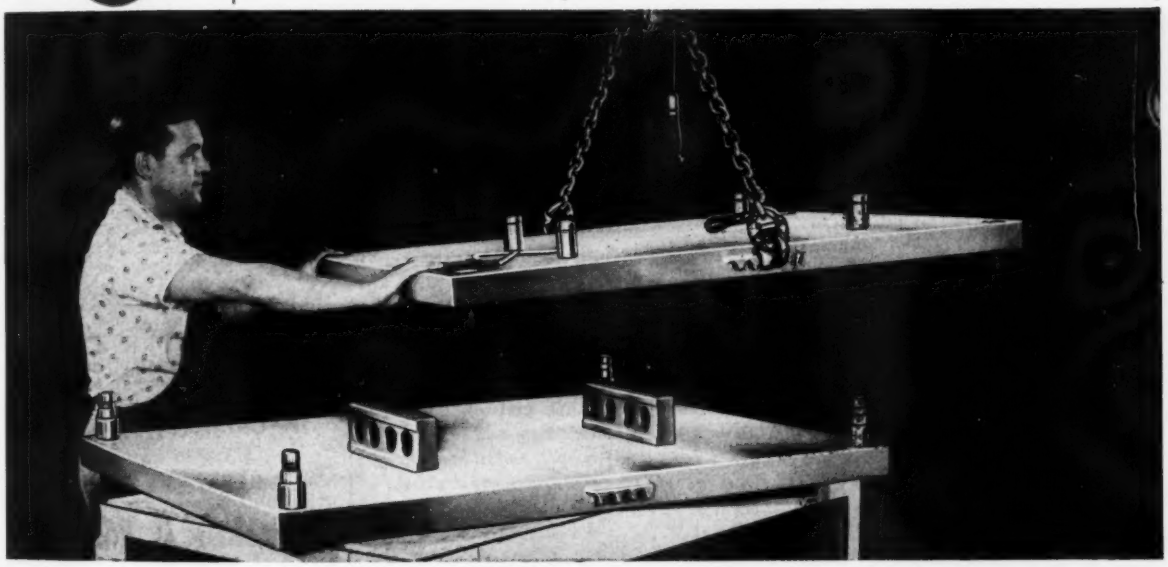

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Index Tables, Power Assemblies, Stands and Control Panels Now Standard and Cataloged —

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CATALOG NO. 301 . . . AN OUTSTANDING CONTRIBUTION TO STANDARDIZATION IN AUTOMATION

There has never been anything like it! 24 pages of engineering data vital to anyone interested in automatic assembly. More than 150 high speed, precision index tables cataloged by dial sizes from 12" to 120"; 4 to 36 stations; and indexing periods varying from ¼ to ¾ of the cycle time. Load ratings are shown for various RPM. All dimensions are given. Standard power assemblies are shown with speeds and dimensions. Stands, electrical control panels and other auxiliary items are listed. *You can even order a complete rotary transfer machine from stock with weeks off normal delivery time and substantial price reductions!*

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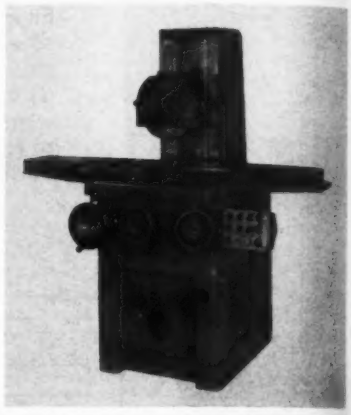
PRODUCES NEW SURFACE GRINDER

Designed for both production and toolroom use is the new Reid-O-Matic 824 surface grinder produced by Reid Brothers Co., Inc., Elliott St., Beverly, Mass. The power operated grinder, with "push button" control, handles workpieces up to 8" x 24".

Dial controlled speed of the table is variable from 0 to 75 ft/min in infinitely fine degrees, and cross-feed drive, for fine adjustments from 0.001" to ¼". A selector switch controls cross-feed at either or both ends of the table travel.

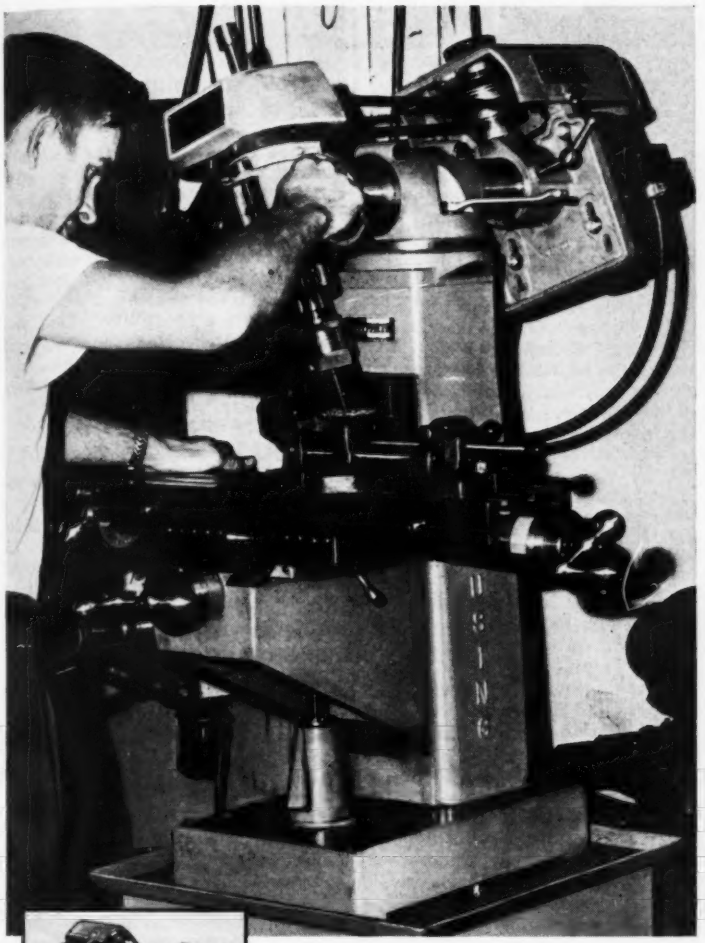


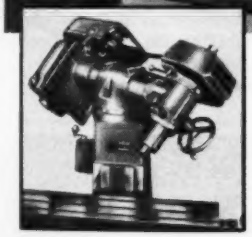
Featured on Model 824 is low-pressure automatic lubrication for constant protection of all moving parts. The table is connected by a timing belt drive to the transmission for more positive drive, eliminating chain chords on finished work.

The elevating hand wheel has a slip ring for zero resetting and vernier for adjustment in 0.0001" increments. The spindle mounts a 12" wheel for 1800 rpm operation.
Circle Inform-A-Gram No. D4.

FOR COMPLETE INFORMATION ABOUT REPRINTS AND TECHNICAL BOOKS AVAILABLE SEE THE HUEBNER PUBLICATIONS' ADS ON PAGES 44 AND 108.

"EXCEPTIONAL SENSITIVITY" with the CLAUSING VERTICAL MILL





The spindle head can be swiveled in a vertical plane and set at any angle, and turret rotated in a horizontal plane making it possible to mill, drill, bore, ream and shape at all angles with one set-up. Quill has micrometer depth control stop and two feeds, lever and hand wheel.

The heart of the CLAUSING MILL is its rigid, high precision spindle head. It has 7 ball bearings . . . spindle is chrome nickel steel, hardened and ground . . . quill, ground and hard chrome plated, has full-length honed bearing seat . . . overarm is an electric furnace casting, with ¾" thick walls, precision ground.

D & S Tool and Manufacturing Co., widely known for precision tool and die work, reports: "Our men prefer CLAUSING MILLS for die working. They have a sensitivity you don't get in larger machines that really pays off in accuracy and efficiency on every operation using small cutters, and the time they save in job set-ups is substantial."

MOST ACCURATE MACHINE OF ITS TYPE and CAPACITY

Each CLAUSING Mill must pass these rigid tolerance tests:

1. Top of table perpendicular to column ways, both directions, within .0005" in 8" travel.
2. Table top, front to back, square with column ways 0 to .001".
3. Table, parallel to turret within .001".
4. Spindle square with table, front to rear, within .001" T.I.R. in 5" circle.
5. Spindle taper (internal) run out within .0002" at spindle nose.
6. Table T-slots parallel to table dovetail ways within .0005" in 8" longitudinal travel.

CONDENSED SPECIFICATIONS

Size of Table	6" x 24"
Longitudinal Table Travel	15"
Transverse Table Travel	5"
Vertical Table Travel	11⅝"
Maximum Distance Spindle to Column	8¾"
Quill Travel	3"

Spindle Speeds: Six, 180 to 3250 RPM. No. 7 Brown and Sharpe or No. 2 Morse Taper Spindle Optional. Operates from ½ or ¾ H.P., 1725 RPM Motor.

MILLS, DRILLS, BORES, REAMS AND SHAPES AT ALL ANGLES WITH ONE WORK SET-UP!

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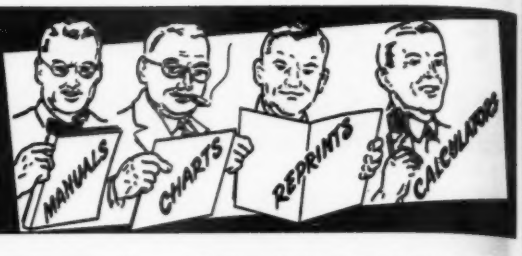
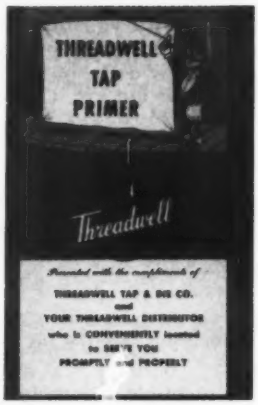
SHOP AIDS





This Tap Primer provides basic information on taps, their uses and description. It covers the many characteristics, qualities and features of taps of various designs and purposes. Illustrated with drawings and photos, the tap primer proceeds step by step to explain tap and thread terminology. Also shown are the stages of manufacturing ground thread taps. On the back cover is found a table of decimal equivalents of fractions. Copies of the Tap Primer, Form T-243, are made available by Threadwell Tap & Die Co., Greenfield, Mass., or — **Circle Inform-A-Gram No. C1.**

A Flat Ground Die Steel Chart lists all of the standard stock sizes available from Simonds Saw and Steel Co., Fitchburg, Mass. In addition, this new large-sized chart covers stock square sizes. Also given is general information on oil and air hardening with heat treat data for both. **Circle Inform-A-Gram No. C2.**

Vertical Filing Systems are detailed in an eight-page catalog, "The Plan Hold Story." Shown are four different methods of vertically filing blue prints, etc. The Plan Hold friction type binders made of lightweight aluminum, hold the prints in any available rack or plan file without punching or drilling holes, or mutilating the plans in any way. Each will hold from one to 150 sheets. For copies of Catalog 5, complete with price list and ordering information, write to Plan Hold, 5204 Chakemco St., South Gate, Calif., or — **Circle Inform-A-Gram No. C3.**

Weldrawn Tubing is described in Data Memorandum No. 2 issued by Superior Tube Co., 1733 Germantown Ave., Norristown, Pa. Sizes listed in a table of analyses and production limits are from 0.0625 to 2.500 O.D., depending upon the analysis. The brochure notes the requirements of the material to be classified as Weldrawn. Also listed are the 18 materials in which Weldrawn tubing is available. In addition, the tolerances are given in chart form, and quality control and the method of manufacture discussed. For your copy, contact the company, or — **Circle Inform-A-Gram No. C4.**

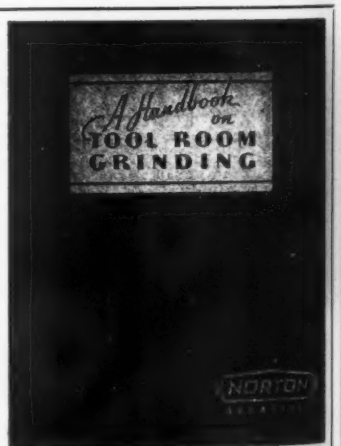
Design, Properties and Applications of Brass, Bronze and Aluminum Forgings are found in a new 32-page booklet. Featured is a six-page discussion of design factors involved in specifying and producing forgings, covering strength, core size, flash line, projection, staggered lines, fillets, lettering and dimensional tolerances. In addition, material is presented on the advantages of using brass or aluminum forgings, the available alloys and their properties, and how Titan forgings are made. Also given are a commercial dimensional tolerance table, machining advantages, a list of forging terms and ordering data. Copies of the forging booklet are supplied by Titan Metal Mfg. Co., Customer Service Div'n, Dept. U-20, Bellefonte, Pa., or —**Circle Inform-A-Gram No. C5.**

A Deep Hole Drilling Tool Manual has been published by Boyar-Schultz Corp., 2000 S. 25th Ave., Broadview, Ill. It gives instructions for deep hole drilling on screw machine and turret lathes. Discussed are the DA nonrevolving tool, the RDA revolving tool and the VD driving attachment and their uses with various materials. Also presented is a speed and feed chart and a list of steels to serve as a guide for machinability. One section is devoted to detailing four specific jobs, complete with drawings. Obtain your copy of the manual from the company, or — **Circle Inform-A-Gram No. C6.**

Weighing Information can be assembled quickly with the aid of a Check-Chart Kit from Toledo Scale Co., 1211 Telegraph Rd., Toledo 12. It helps management to get a better overall picture of weighing facilities in a plant. The kit contains report and summary forms, instructions, a booklet on the relationship of weighing to costs and a pictorial identification reference of modern industrial scales. Get your copy of the industrial weighing Check-Chart Kit from the company, or — **Circle No. C7.**

High Speed, Tool, Stainless, Heat Resisting and Alloy Steels are included in a die-cut steel analysis wall chart. Also covered are nitriding, machinery and special purpose steels. Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, will issue copies of the wall chart, or — **Circle Inform-A-Gram No. C8.**

This Handbook on Toolroom Grinding deals with general tool grinding, carbide tools and cast alloy tools. Also included are the sharpening of high-speed steel, non-ferrous cast alloy and cemented carbide tools. The first section is devoted to wheels for toolroom grinding. Other sections cover grinding the chip breaker on carbide tools, hand honing of carbide tools, miscellaneous toolroom and carbide grinding operations, and miscellaneous abrasive products and Norton grinding machines for the toolroom. Tables of useful information are found in the last section. For copies of this handbook, Form 781, write to Norton Co., Worcester 6, Mass., or — **Circle No. C9.**



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SIMPLE TO OPERATE...DIGITAL READING

The new FRINGECOUNT micrometer brings laboratory precision with increased speed to your inspection and quality control departments.

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The most stable measuring standard known — the wavelength of light — is the gage put to use in the FRINGECOUNT micrometer. It combines the interferometric principle with an electronic system which counts light fringes — projects them into a digital counter for fast interpretation into a dimension.

Operation is simple — just *two* push-button controls. Other FRINGECOUNT advantages:

- Eliminates need for expensive master blocks.
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- Adapts to many special measuring situations through the use of different anvils and spindles.
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Find out how the FRINGECOUNT can be used in your operation; Write us today, Department..... for Bulletin LP-3521.

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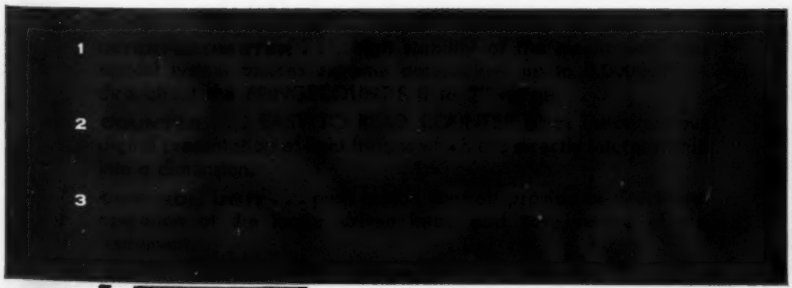

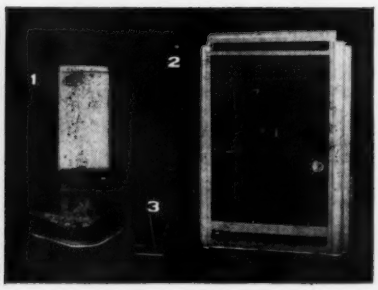

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Gentlemen:
With reference to the Double Cam-Lever (500) and Eye-Bolt (500), we have conducted experiments to determine the amount of clamping force a man can exert with this device, lubricated.
Without the use of any auxiliary equipment, it was found that a man could exert up to 3,450 pounds, by bringing the lever to a position 90° with the Eye-Bolt.
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FINGER TIP CAN TIGHTEN CLAMP

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This Double Cam Lever offers superior design and engineering features—assuring greater safety, performance, strength and durability.

- **Maximum Job Clearance.**
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- **Constant Maximum Clamping Pressure—perpendicular to center line of lever.**
- **Certified 6-Ton Back-Pressure Resistance—no danger of cam backing up.**
- **Ready to Use—no altering needed on assembly.**
- **No Lever Breakage—solid steel handle.**
- **This cam can be applied to your specially designed assemblies. Quotations on request.**

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9	27	47	96	118	137	160	1402	1772	1822	1873	1923	1973	2032	2074	2134
10	29	48	97	119	139	161	1403	1773	1831	1874	1931	1974	2033	2081	
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13	32	52	101	122	143	164	1453	1776	1841	1881	1941	1983	2042	2092	
14	33	53	103	123	144	165	1461	1777	1842	1882	1942	1984	2043	2093	
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A1	A19	A37	A55	B7	B25	B43	D2
A2	A20	A38	A56	B8	B26	B44	D3
A3	A21	A39	A57	B9	B27	B45	D4
A4	A22	A40	A58	B10	B28	B46	E1
A5	A23	A41	A59	B11	B29	B47	E2
A6	A24	A42	A60	B12	B30	B48	E3
A7	A25	A43	A61	B13	B31	B49	E4
A8	A26	A44	A62	B14	B32	B50	E5
A9	A27	A45	A63	B15	B33	C1	E8
A10	A28	A46	A64	B16	B34	C2	E7
A11	A29	A47	A65	B17	B35	C3	E8
A12	A30	A48	A66	B18	B36	C4	E9
A13	A31	A49	B1	B19	B37	C5	E10
A14	A32	A50	B2	B20	B38	C6	E11
A15	A33	A51	B3	B21	B39	C7	
A16	A34	A52	B4	B22	B40	C8	
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THESE INFORM-A-GRAM CARDS are for the convenience of *TOOLING and PRODUCTION* readers who, we know, rarely have stenographic help at their beck-and-call while reading. To get further information concerning selected items featured — all one needs is an INFORM-A-GRAM card and a pencil or pen to circle the numbers of the items wanted. If there is no identifying number, use the page number.

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A7	A25	A43	A61	B13	B31	B49	E4
A8	A26	A44	A62	B14	B32	B50	E5
A9	A27	A45	A63	B15	B33	C1	E8
A10	A28	A46	A64	B16	B34	C2	E7
A11	A29	A47	A65	B17	B35	C3	E8
A12	A30	A48	A66	B18	B36	C4	E9
A13	A31	A49	B1	B19	B37	C5	E10
A14	A32	A50	B2	B20	B38	C6	E11
A15	A33	A51	B3	B21	B39	C7	
A16	A34	A52	B4	B22	B40	C8	
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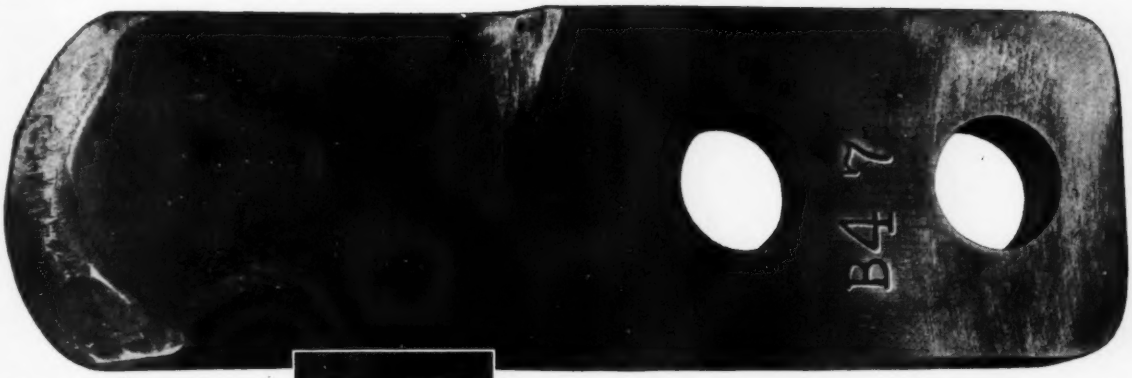

This punch gave double service!

This block had double life!

This die lasted 50% longer!

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gives you more runs for your money

. . . anywhere from 1½ to 5 times the Performance!

SOME TYPICAL EXAMPLES

B-47 dummy blocks, vs. 9% and 12% tungsten types, extruded more than twice as many brass and copper tubes. B-47 dies outperformed 12% tungsten type 1½ to 1.

B-47 punches, vs. low-carbon 18-4-1 type, hot pierced more than twice as many eyes in steel axes. See top picture.

B-47 die inserts, vs. 9% tungsten types, hot pressed more than twice as many steel side gear forgings. B-47 die inserts, vs. regular insert material, performed better than 5 to 1.

B-47 dummy blocks, vs. 5% tungsten-5% chromium types, extruded twice as many copper and brass tubes and rods. B-47 dies outperformed 12% tungsten-12% chromium type.

B-47 punches, vs. 5% chromium type, hot extrusion forged 1½ times as many automotive steel front axle spindles.

B-47 die inserts, vs. 9% tungsten types, extruded 1½ times as many high alloy steel automotive valves. This is considered a very difficult job for any grade of hot work steel.

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This four-page folder gives technical data on B-47 for brass extrusion dummy block and dies, valve extrusion die inserts, hot punch tools, forging die inserts, press forging dies, and hot work in general. *Write for your copy today.*

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Developed originally for applications in the copper and brass industry, B-47 has given excellent results on difficult hot work jobs on steel. B-47, when properly heat treated, exhibits a well rounded combination of red hardness, toughness, and resistance to wear and heat checking that makes it a valuable addition to the Allegheny Ludlum group of hot die steels.

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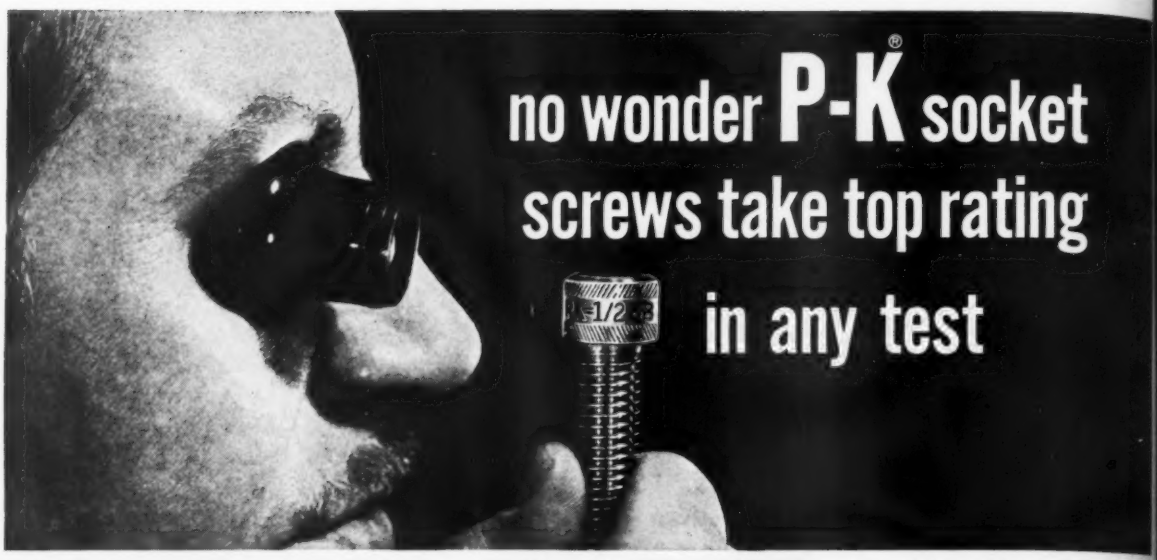
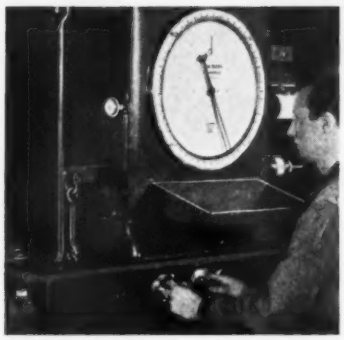


no wonder P-K® socket screws take top rating in any test

ROCKWELL HARDNESS TEST. With this familiar laboratory device, the hardness of screws is carefully tested as a check on heat-treatment.



PERFORMANCE. Both the raw material and finished screws are tested on this equipment to determine ductility and strength under tension loads.

HEX DIMENSIONS. To make sure that the hex meets exacting specifications, a team of inspectors check dimensions across flats at the machine.

HEAD DIAMETERS. As heads are shaved on automatic machines, such as those shown here, constant checking by operator and inspector maintains accuracy.

THREAD CONTOUR AND LEAD. The Comparator permits checking of thread contour and lead of screw heads against Class 3A Tolerances.

SEE FOR YOURSELF

These are just a few of the steps in the rigorous test and inspection routine conducted in Parker-Kalon's modern fastener plant. Exacting quality control assures that all "doubtful screws" are eliminated—that every P-K Socket Screw delivered to you is first quality. Parker-Kalon guarantees that it's first quality. In strength, dimensional accuracy and overall uniformity, you can be sure . . . "if it's P-K, it's O.K."

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Cut-off wheels . . .

These thin, fast-cutting, resinoid-bonded wheels slice through the hardest-to-cut materials in seconds, giving more cuts per wheel — less stock waste — and essential accuracy in cutting lengths to close tolerances. They often eliminate finishing, too, since the ends they produce are smooth. Operating speeds from 10,000 to 12,000 s.f.p.m. (16,000 s.f.p.m. on specially designed machines.) Write for bulletin ESA-163 and name of distributor.

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extra with cutting mileage built in

Chicago-Latrobe High Speed Reamers are made as if they were intended to last forever . . . and they almost do. So next time order Chicago-Latrobe from your distributor . . . accept no substitutes. The extra life will save you money; the complete line assures service.

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Drills
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Special Tools

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Will You Be There?

Oct. 30-Nov. 1. National Fluid Power Association. Fall Meeting. Hotel Cleveland, Cleveland, Ohio.

•

Nov. 1-4. National Tool & Die Manufacturers Association. Annual Meeting. Hotel Statler, Hartford, Conn.

•

Nov. 7-9. National Machine Tool Builders Association. Fifty-fifth Annual Meeting. Edgewater Beach Hotel, Chicago.

•

Nov. 13-15. Investment Casting Institute. Fourth Annual Meeting. Sheraton-Cadillac Hotel, Detroit.

•

Nov. 15-16. Operations Research Society of America. Tenth National Meeting. Hotel Mark Hopkins, San Francisco.

•

Nov. 15-16. Institute of Radio Engineers. New England Radio-Electronics Meeting. Hotel Bradford, Boston, Mass.

•

Nov. 25-30. American Society of Mechanical Engineers. Annual Meeting. New York City.

•

Nov. 26-27. Conference on Office Automation for Senior Officers. New Yorker Hotel, New York City.

•

Nov. 26-30. Human Engineering Conference. New Yorker Hotel, New York City.

•

Nov. 26-30. Third International Automation Exposition. New York Trade Show Building, New York City.

NECROLOGY

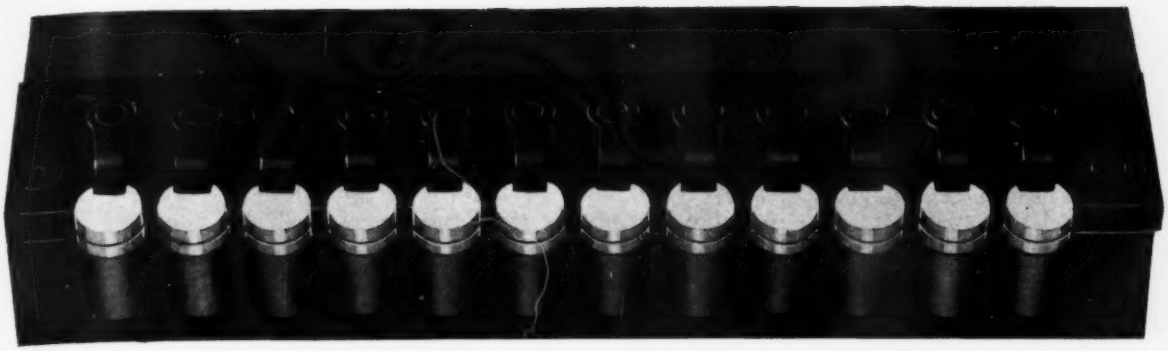
Freas M. Long, 72, retired director of foreign sales for Gisholt Machine Company, died in July.

Rudolf Feitl, 57, technical supervisor of Waldes Kohinoor, Inc., died in August, after a long illness.

Anthony W. Taylor, 56, director of purchases for Crucible Steel Company of America, died in September at Miami, Fla.

Joseph M. Schaeffer, 71, president of The Waterbury Farrel Foundry & Machine Co., died in September at Waterbury, Conn., after a brief illness.

Nathan Ransohoff, founder and chairman of the board of Ransohoff, Inc., died in September in Cincinnati, Ohio.



Kendex* multiple grooving tool, with 12 Kennametal "turn-over" button inserts, and shims of Kennametal for fast groove cutting and rapid, accurate indexing

KENNAMETAL* Special Tools for Special Jobs

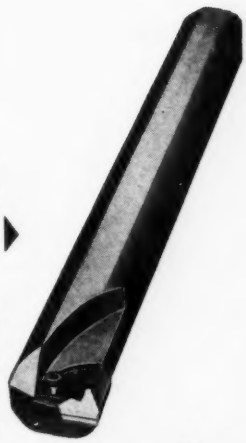
Designing special tooling to meet specific conditions is a basic part of Kennametal Engineering

Many machining jobs often can be done better, faster, or at less cost with a new cutting tool . . . or a tool that is adapted to the existing conditions. The photographs illustrate this point, showing Kendex* Tooling re-designed for specific jobs.

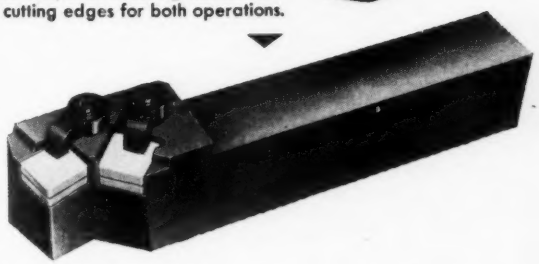
This is part of the Kennametal tool engineering service. Experienced Kennametal engineers will work with you to find the best approach to your metal-cutting problems. Often a modified standard tool is the answer, and your Kennametal tool engineer will recommend it. Sometimes an entirely new approach with specialized tooling may be the only solution to improve production. In either case, the chances are that Kennametal's Engineering Service during the last 18 years has solved a similar problem. Result: Time is saved . . . development work is reduced to a minimum . . . the basic design has been proven.

If you have a stubborn, high-cost production job, perhaps your Kennametal tool engineer can quickly suggest a solution. He devotes his time exclusively to tooling problems with one objective —to get the right tool and right grade of Kennametal on the job. His broad experience in tool design and tool application is supplemented by that of our Research and Engineering staffs. All are constantly at work to provide the best tools and most practical techniques for metal-cutting and forming operations. Call your Kennametal Representative or write to KENNAMETAL INC., Latrobe, Pa.

Boring bar utilizing Kendex clamped-holder principle and Kennametal triangular inserts of the "turn-over" throw-away type . . . eliminates grinding . . . reduces downtime.



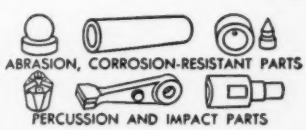
Facing and chamfering completed in one pass with a two-in-one Kendex Tool and Kennametal inserts. Another advantage: Since only the middle of chamfering insert is used, the two inserts may be interchanged after use, thus doubling the number of cutting edges for both operations.



*Trademarks

B-11,404

INDUSTRY AND KENNAMETAL ...Partners in Progress



CIRCLE INFORM-A-GRAM KEY NO. 121

BUDGET TOOLING

With research and development playing an ever more important role in business planning, manufacturers have become conscious of the need for producing less expensive prototype models. The prototype model gives them the opportunity to evaluate the design engineer's blueprints; to establish basic shipping and storage requirements; and to test consumer acceptance of a new or revised model. The advent of epoxy tooling compounds made the production of prototype less costly.

Epoxy tooling compounds have also brought the short-run production specialties within an economically feasible price range. Previously, such short runs were not justified by the large tooling investment required.

Representative of a promotional-type article that can be fabricated economically in small quantities is the "Junior Star Chief", a one-third size version of the flashy Pontiac "Star Chief" convertible (Fig. 1). Produced from molds made of epoxy tooling compounds by Rezolin, Inc., and based on Bakelite epoxy resins, the automobile points up the features of budget tooling.

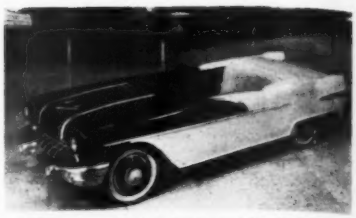


Fig. 1. The Junior Star Chief measures more than 6′ from bumper to bumper, about 38″ wide, and weighs about 150 lbs. It is powered by a conventional starting motor geared down to produce a maximum speed of 5.6 mph.

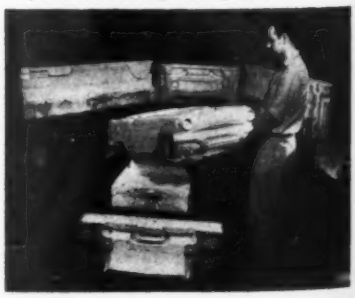
Production Details

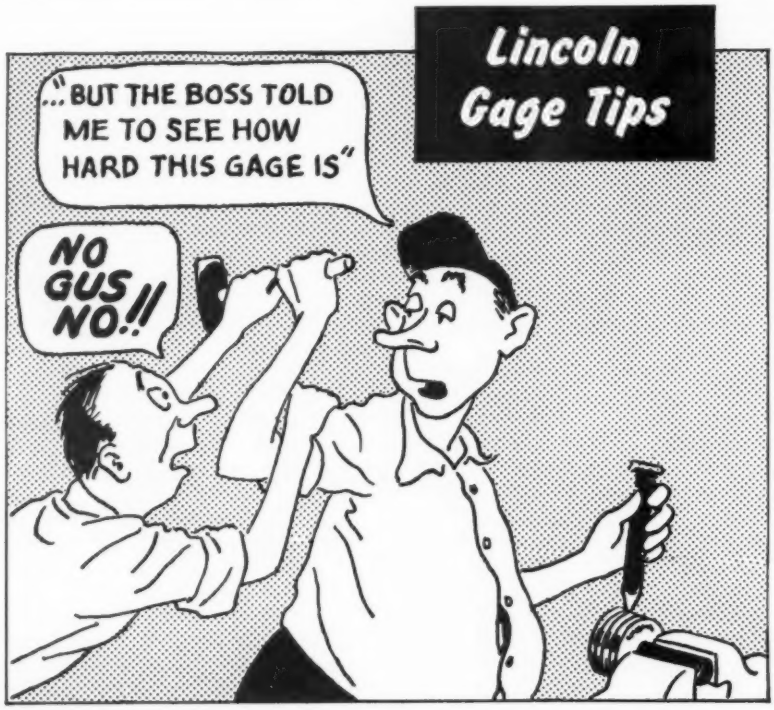
The car was scaled down from the original engineering drawings of the 1956 Pontiac "Star Chief" convertible. From the drawings, a clay model was prepared in the exact dimensions of the finished pint-sized automobile. A female master mold in five sections — front, rear, two sides and top — was prepared from the clay model using "Rezolin" tooling compounds reinforced with glass cloth. Epoxies produced a smooth, hard surface on the mold and gave it extra strength to resist wear and handling.

A male master model was produced from the original female mold, and was, in turn, used to duplicate the female into several production molds. The original female mold was released for production within two weeks of the completion of the clay model. Within six weeks of this date, all molds were in service and the entire production run of several hundred car bodies was completed in approximately 12 weeks.

In actual production of the car bodies, the five sections of the fe-

Fig. 2. The five mold sections, shown here with the reinforced polyester resin body shell, are clamped together to form a complete body mold. Wear-resistant and light in weight, these sections are made of epoxy tooling compounds based on Bakelite epoxy resins. The compounds maintain extremely close tolerances — dimensional accuracy to yield interchangeable parts.





TEST FOR HARDNESS on the shank of a plug gage, never on any gaging surface. Rings should be checked on the face, close to the threads.

Metal hardness is a factor in the wear-life of a gage. That is why EVERY GAGE BLANK on every order is checked by our trained Rockwell operator before it goes to the thread or O.D. grinders. We receive no complaints about soft gages.

This extra precaution is part of our extensive, rigid quality control program. Under this program we maintain a standard of excellence that assures complete satisfaction for users of Lincoln thread plug and ring, cylindrical plug and ring, and special gages.

Write today, or teletype* for 20 page catalog. Fully illustrates our complete gage line and contains easily read thread standards.

*Teletype No. Roseville 834.

LINCOLN GAGE CO.

23902 Harper Ave., St. Clair Shores, Mich.

CIRCLE INFORM-A-GRAM KEY NO. 122

male epoxy mold (Figs. 2 and 3) were clamped together in position and coated with a mold release agent. Glass mat was laid-up in strips into the mold and saturated with polyester resins. A translucent film bag was placed over this and air pumped out from under the lay-up. The weight of the atmosphere applied pressure to the lay-up while heat lamps speeded the cure of the polyester resins. Produced in this manner, the impact resistant body shells were easily removed by collapsing the mold sections.

The body shells were then placed in a routing and trimming fixture

Fig. 3. The rapid production of the child-sized auto was largely due to the ease of duplicating the master mold model into several production molds. Reinforced epoxy molds and fixtures are quickly reproduced by direct lay-up from the master model.

Fig. 4. Completed body shells are trimmed in a routing fixture, where exact locator pads made of "Rezolin" tooling compounds hold the molded body in position. The dimensional stability of Bakelite epoxy resins assures uniformly trimmed bodies.

(Fig. 4). While the rough edges were cut away, each shell was held in place with exact epoxy locator pads made of "Rezolin" tooling compounds. The shells were painted in a two-toned Pontiac style before final assembly of the starting motor, battery, steering wheel and other accessories was made. The body shells were produced by Modern Pattern and Plastics, Incorporated. Silverstri Art Manufacturing Company was responsible for the final assembly, finishing and distribution of the car.

Fenn Opens New Metallurgical Lab

The facilities of Fenn Manufacturing Company's modern, new metallurgical laboratory enables the Newington, Conn., firm to maintain full control over both physical and chemical qualities of raw materials and to provide analyses for buyers of Fenn metal forming equipment.

Under the supervision of Chief Metallurgist Robert Turnbull, the lab offers heat treatment analysis of metal, determinations of the machinability of any metal, and changes in grain structure due to the rolling and swaging processes. Photographic equipment in it makes it possible to record photos of from 0 to 20,000 diameters magnification.

Since Fenn is also a leading producer of precision aircraft parts, the facilities also have full Air Force certification.

"CONTROLLED TAP SHARPENING" can make each tap one of your most efficient cutting tools.

BLAKE Flute and Chamfer Grinders can reduce your tap costs over 60%, and assist you in meeting tighter standards on fits by creating or restoring:

1. Exact indexing of cutting edges.
2. Best rake or hook angle.
3. Correctly ground spiral points.
4. Perfectly relieved chamfers.

NEW—AIR OPERATED VERTICAL SLIDE Now Available on BLAKE Flute Grinders. This is the greatest advance in tap sharpening since the BLAKE Flute Grinder was introduced, giving you *faster* tap sharpening with *smoother* finish for still *longer* tap life! Present machines in use can be converted to Air Operation of the Vertical Slide.

Write for details NOW!

EDWARD BLAKE COMPANY INC.
MANUFACTURERS OF FLUTE AND CHAMFER GRINDERS
442 CHERRY ST., WEST NEWTON 65, MASS.

Exclusive Distributors of:
BLACK DIAMOND PRECISION DRILL GRINDERS • SURFACE FINISH STANDARDS • WORCESTER DRILL GRINDERS

CIRCLE INFORM-A-GRAM KEY NO. 123

For Ease and Convenience Use TOOLING and PRODUCTION Inform-A-Gram Cards

A 3-Ft Radial Drill is the subject of a bulletin from Veet Industries, 25753 Groesbeck Hwy., East Detroit, Mich. It features a flame-hardened column for lasting precision, an extra large table and radial operation. The drill is ideal for production of tools, dies, jigs, fixtures and similar work that requires precision and accuracy. Features, specifications and details are found in the bulletin.
Circle Inform-A-Gram No. B1.

An Answer to Materials Handling Problems is provided by Palletainers. A brochure is divided into sections such as warehousing, bulk load, etc. so that particular applications are keyed to specific industries. The illustrated brochure also details construction features and specifications. Union Steel Products Co., Albion, Mich., will provide copies of the brochure on Palletainers, or —
Circle Inform-A-Gram No. B2.

Linear and Angular Micro Positioning Systems are covered in a new bulletin. The Inductosyn (R) is an electronic automatic machine tool control capable of positioning a machine tool carriage with a maximum linear error of 0.0001" or positioning a rotational member with a maximum angular error of 5 sec of arc. The control can be applied for automatic positioning control and numerically controlled contour machining for large drill presses, boring and milling machines, grinders, jig borers, gear cutters and lathes. Request copies of Bulletin 819 from Farrand Controls, Inc., 4401 Bronx Blvd., New York 70, or —
Circle Inform-A-Gram No. B3.

The Gold-N-Ring Sealtight Push Button Control Switch has been designed for a wide range of applications in industries that require dependable high-quality performance from components that make up control stations and panels. Complete interchangeability of units and their components provides for flexibility and ready adaptation to multiple systems. Details on the dust, oil and water-tight unit are found in Bulletin ECS-56 put out by Electric Mfg. Div'n, The National Acme Co., 170 E. 131st St., Cleveland 8, or —
Circle Inform-A-Gram No. B4.

A Catalog of Transparent Acetate Envelopes for industrial use has been made available by American Kleer-Vu Plastics, Inc. It contains photos and complete information about dozens of different styles and sizes of transparent envelopes. For a copy of the catalog, contact Dept. T.P., American Kleer-Vu Plastics, Inc., 53-06 Grand Ave., Maspeth 78, N. Y., or —
Circle Inform-A-Gram No. B5.

Automatically Deburr Tapped Holes with the Burr-Bit device. By using this device, the hole is chamferred while the tap is being withdrawn from the workpiece. It is designed for use on most material such as steel, cast iron, aluminum, brass, copper and plastic. It will fit all makes of two and four fluted tapers and can be used either by friction type tapping heads or lead screw tappers on both single and multiple units. An illustrated circular is supplied by Vernon Devices, Inc., 481 E. 3rd St., Mt. Vernon, N. Y., or —
Circle Inform-A-Gram No. B6.

TOOLING and PRODUCTION'S Inform-A-Gram Section is a CARDload of Information

An Industrial Power Press Line is featured in a new catalog from Zeh and Hahnemann Co., 188-7 Vanderpool St., Newark 5, N. J. Described and illustrated are standard, high production and patented Power Percussion presses. Detailed specifications, capabilities and capacities are included in tabular form. For your copy, write to the company, or —
Circle Inform-A-Gram No. B7.

Convey Heavy Items such as spiral metal turnings, stampings, castings, forgings, etc. with the Pan-Link conveyor which is built in 10-ft standard sections. Since no conventional chain is included in the design, the flat side skirts serve as links to insure correct pitch and as sides to contain conveyed materials. The wheels are mounted on an axle rod which passes through a set of double bushings. Hapman Conveyors, Inc., Kalamazoo, Mich., will supply copies of Bulletin PL-47 with details, or —
Circle Inform-A-Gram No. B8.

Miniature Taps, Dies, Screws, Drills and Tools are featured in a new catalog being offered by J. I. Morris Co., Southbridge, Mass. This catalog contains dimensional data on all popular sizes in the range of 56 to 160 threads/in. Also given are prices of stock items and an outline of the company's special order facilities.
Circle Inform-A-Gram No. B9.

A Spindle Repair and Rebuilding Service is being offered by Pope Machinery Corp., Haverhill, Mass. The company provides fast repair service at lower costs. Bulletin R-1, containing details on the service, is supplied by the company, or —
Circle Inform-A-Gram No. B10.

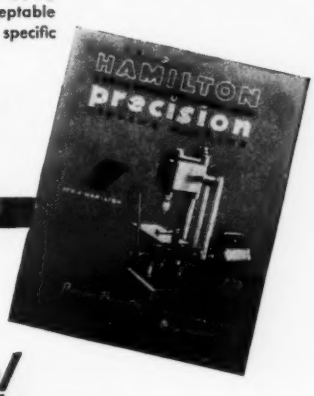
Save Material and Cut Scrap Waste and Chip Handling with Harvey hollow aluminum bar stock. An eight-page brochure discusses tolerance, mechanical properties and applications of the stock. Also presented are case studies, comparison charts and complete tables of the standard sizes available in round and hexagonal stock, listing the wall thicknesses, dimensions and weight per ft. Harvey Aluminum, 19200 S. Western Ave., Torrance, Calif., will supply copies of the brochure, "Hollow Aluminum Bar Stock," or
Circle Inform-A-Gram No. B11.

"Barrel-Finishing with Norton Tumblex Abrasives" includes information on types of barrels, selection of abrasive, cleaners and time cycles. It also presents before and after photos and case histories of examples of deburring, finishing for plating and precision forming of radii to blueprint specifications. Request Form 501 from Norton Co., Worcester 6, Mass., or —
Circle Inform-A-Gram No. B12.

Square Type, Steel Head Hydraulic Cylinders with tie-rod construction are featured in a new catalog announced by Lynair, Inc., 3100 E. Michigan Ave., Jackson, Mich. The cylinders are furnished with automotive-type piston ring packing backed up with "O" rings which assures a minimum of bypass. For details, obtain copies of the catalog from the company, or —
Circle Inform-A-Gram No. B13.

There is no way under the sun to do small, precision tapping with "production" speed, satisfactory tap life and acceptable accuracy, other than to use a tool designed for the specific purpose.

THE *Hamilton* SUPER-SENSITIVE SMALL HOLE TAPPING MACHINE IS SUCH A TOOL!



WANT ALL THE FACTS

Write for Hamilton Bulletin No. 5203. Address The Hamilton Tool Company, 832 South Ninth Street, Hamilton, Ohio.

IT'S A *Hamilton Tool*
USE IT WITH CONFIDENCE

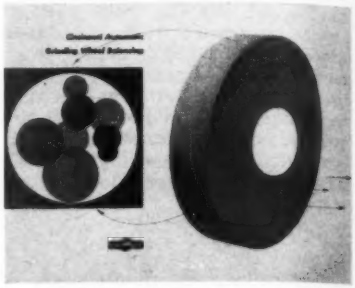
CIRCLE INFORM-A-GRAM KEY NO. 125

A Magnet of 1001 Uses is the Grippy magnet. Among its uses are maneuvering of parts into gages for inspection; magnetically holding extension cords to steel posts, machinery or other ferrous surfaces; holding temporary signs; and making a temporary jig on bed of drill press or any machine. A Giant Grippy is also produced. For complete details and price information, obtain a circular from The Dilley Mfg. Co., 1679 Ansel Rd., Cleveland 6, or —
Circle Inform-A-Gram No. B14.

Solve Automotive, Electronic, Machine Tool and Other Assembly Problems with self-locking metal nuts. Con-Torq nuts made for several bolt and screw sizes, can be reused repeatedly without impairing their locking ability and are easily installed with standard tools. Complete information on the line of self-locking nuts is provided in a 6-page catalog obtainable from Con-Torq, subsidiary of North & Judd Mfg. Co., New Britain, Conn., or —
Circle Inform-A-Gram No. B15.

GROUND MULTIPLE THREAD MILLING CUTTERS
FACE MILLS
FORM RELIEVED MILLING CUTTERS
BROACHES
SINGLE POINT TOOLS
CONTINENTAL DRIVE TOOLS
FORM TOOLS
Newest Materials and Methods—
Plus the Toughest "Proving Ground" in Industry
What makes one tool better than another? Engineers boil it down to three factors: (1) careful selection of the newest tool materials, (2) proper tool design, (3) accurately controlled heat treatment.
Continental is constantly testing these three factors in actual production in Ex-Cell-O plants.
Call your Ex-Cell-O representative or contact Continental direct.
CTW
56-62
Continental TOOL WORKS
Division of Ex-Cell-O Corporation, Detroit 32, Mich.
CIRCLE INFORM-A-GRAM KEY NO. 126

Increased Production, Greater Accuracy and superior finish result from Cincinnati automatic grinding wheel balancing which is 10 times as accurate as conventional balancing. It provides precise balancing of the grinding wheel in a few seconds



under dynamic conditions and eliminates vibration due to unbalance and resultant chatter. Automatic grinding wheel balancing is standard equipment on the Cincinnati Filmatic. For details, see Booklet G-637-2 issued by The Cincinnati Milling Machine Co., Cincinnati 9, or —
Circle Inform-A-Gram No. B16.

A Boring Tools Catalog is now being offered by Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport 7, Conn. Available in high speed steel or carbide, this line of tools is used with Moore jig borers for tool room or production use. Featured is a boring chuck set. In addition, other Moore accessories including drill chucks, collets, reamers, spotting tools, etc. are pictured in the catalog.
Circle Inform-A-Gram No. B17.

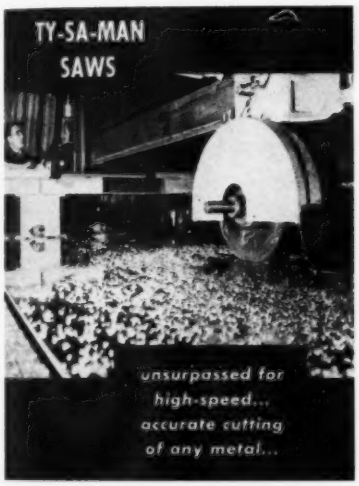
A New Milling Cutter Catalog has been released by Viking Tool Co., Shelton, Conn. The catalog has separate sections for high speed steel and carbide cutters. Each section is broken down into light, medium and heavy duty cutters. Also covered are national standard taper arbors and centering plugs. One section of the catalog is devoted to special milling cutters. The company will make available copies of Catalog 561, or —
Circle Inform-A-Gram No. B18.

Powder Metal Presses are featured in a new 24-page catalog. The complete line of presses, composed of 37 different models, ranges in capacity from 1½ to 300 tons and includes both single-punch and rotary types. Recent additions covered include Model 640 50-ton multiple motion press, Model 713 300-ton hydraulic press and high-speed rotary press, Model 533. Copies of Catalog 815 are made available by F. J. Stokes Corp., 5500 Tabor Rd., Philadelphia 20, or —
Circle Inform-A-Gram No. B19.

Engineered Systems are the subject of Folder M-133 now available from U. S. Hoffman Machinery Corp., Industrial Div'n, 103 - 4th Ave., New York. The folder lists and describes blowers, exhausters, pneumatic systems, filters, flotation equipment, separators, stills, smooth-flow tubular pipe and fittings, and the Hoffco-Vac vacuum cleaners for industrial use.
Circle Inform-A-Gram No. B20.

Stampings and Assemblies are featured in an illustrated folder published by J. H. Sessions & Son Co., Bristol, Conn. The folder contains information on standard and special stampings, assemblies for the finished product and the facilities available at the company. Get your copy of the folder from the firm, or —
Circle Inform-A-Gram No. B21.

High-Speed, Accurate Cutting of Any Metal is performed by Ty-Sa-Man saws. A catalog covers the models available complete with photos, users and uses of the saws, benefits, construction features and



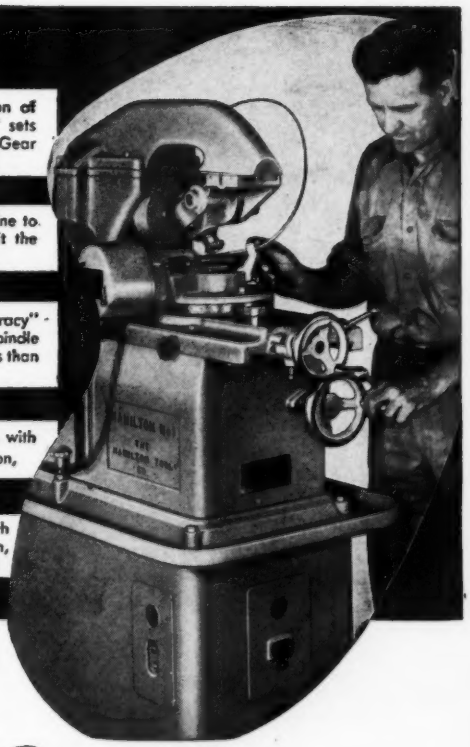
specifications for the 133, 122, 111 and 144 Series. Ty-Sa-Man Machine Co., 1039 White Ave., Knoxville 1, Tenn., will make available copies of Catalog 1235, or —
Circle Inform-A-Gram No. B22.

Roll-Bond, a patterned metal, is used where high efficiency heat and cold transfer is needed. A six-page booklet describes how Roll-Bond is made and lists some of its uses. For your copy of the booklet, "Take a Look at the New Look in Heat Exchangers," contact Metals Div'n, Olin Mathieson Chemical Corp., East Alton, Ill., or —
Circle Inform-A-Gram No. B23.

A Centerless Brushing Method for precision finishing of cylindrical parts is discussed in a 4-page brochure. It explains how to get double duty from centerless grinding machines. The types of finishing possible and characteristics of the brushes needed are described. Copies of the brochure complete with photos and a brush specifications chart, are provided by The Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, or —
Circle Inform-A-Gram No. B24.

A Variety of Large, Heavy Tonnage Drawing, Punching and Blanking Work is handled by eccentric geared presses, Series SE-1, 2 and 4. A bulletin details their features and operating controls and lists the capacities of these presses. Also provided are illustrations and specifications of the presses available. Complete information is found in Bulletin 66 issued by Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo 11, N. Y., or —
Circle Inform-A-Gram No. B25.

NOW CUT COST OF PRECISION GEAR PRODUCTION



THIS FEATURE: "Independent selection of speed, feed and indexing," sets the Hamilton Precision Small Gear Hobber apart from the field,

AND ENABLES the users of this machine to vary speed and feed to suit the material being machined.

THIS FACT, and a "reserve of accuracy" built into the machine, work spindle and hob spindle runout of less than .0002" as an example,

CONTRIBUTES to more gear precision with no sacrifice of gear production,

OR INCREASED gear production with no sacrifice of gear precision, ... OR BOTH!

Prices and specifications without obligation

ASK FOR FREE BULLETIN 5410

Address
The Hamilton Tool Company
832 South Ninth Street
Hamilton, Ohio

IT'S A Hamilton Tool
USE IT WITH CONFIDENCE

CIRCLE INFORM-A-GRAM KEY NO. 127

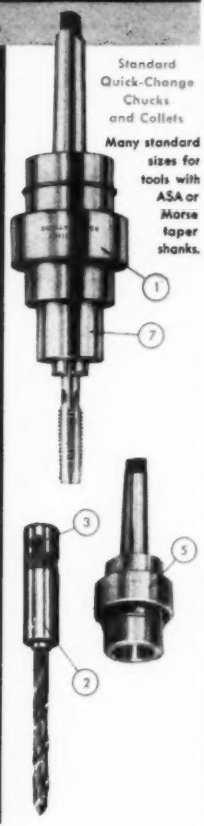
For Applications where Space Is at a Premium, yet high torque output is required, use Bantam speed reducers. These reducers have a maximum power output of 0.1 hp at the low speed shaft. A bulletin describes standard units and units with anti-backlash feature. Each kind is available in over 400 fixed ratios. Metron Instrument Co., 432 Lincoln St., Denver 3, Colo., will supply copies of Bulletin 98 with details on Series 10 and 11, or —
Circle Inform-A-Gram No. B26.

For Accurate Reproduction of Squared Blanks, use Pexto precision power squaring shears. They are engineered for accurate, clean cuts through precision gaging, positive hold-down and built-in blade clearances. The models available are illustrated in a bulletin along with a description of the shears and a list of their features and specifications. Obtain copies of Bulletin 57 from The Peck, Stow & Wilcox Co., Southington, Conn., or —
Circle Inform-A-Gram No. B27.

SCULLY-JONES
QUICK-CHANGE CHUCKS
AND COLLETS

ASSURE GREATER OVER-ALL ECONOMY
FROM YOUR MACHINES AND CUTTING TOOLS

These benefits	. . . for these reasons	. . . result from these PREMIUM features
INCREASE PRODUCTION	Change tools fast without stopping the machine.	1. Operator merely lifts locking ring, without stopping machine, and the collet with cutting tool drops out.
		2. Operator inserts replacement collet in one easy motion. Ring falls into place by gravity, and machine is ready for next operation.
	Faster, easier ejection of cutting tools from collet.	3. Exclusive keyhole-type drift slot permits ejection of tools by a simple twist of the wrist, using "Scully-Drift" or cam-type tool ejector.
REDUCE CAPITAL AND OPERATING COSTS	Minimize investment in special machinery.	4. Give multiple-spindle range to single-spindle machines used for sequence operations like drilling, counterboring, reaming, and tapping.
	Eliminate rejects.	5. Locking ring holds collet firmly and securely in chuck, providing a positive drive to the two balls which are the driving mechanism.
	Reduce maintenance and replacement costs.	6. Chucks are heat-treated and ground to prevent distortion and "nicking."
ASSURE SAFE OPERATING CONDITIONS	Eliminate safety hazards.	7. No ears or sharp edges on locking ring, and ample projection of collet, eliminate possible injury to operator when changing tools in motion.



SCULLY JONES

Call your Scully-Jones factory-trained representative or distributor for complete information and prices.

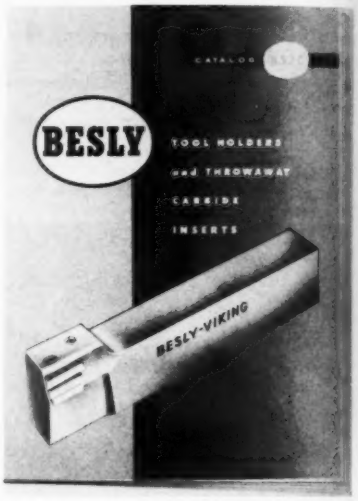
PRECISION HOLDING TOOLS
"Precision Holding" for holding precision

Scully-Jones and Company, 1913 South Rockwell St., Chicago 8, Ill.

CIRCLE INFORM-A-GRAM KEY NO. 128

Greater Holding Power and resistance to shock, vibration and fatigue are features of Driv-Lok grooved fasteners. These fasteners are available in a wide range of types, sizes, materials and heat treatment. A catalog covers their principal and general specifications and details the types available. The catalog also contains drilling procedure, hole tolerances, illustrated applications, application engineering data and weight chart. For copies of the catalog, contact Driv-Lok Pin Co., Sycamore, Ill., or —
Circle Inform-A-Gram No. B28.

A Complete Line of Toolholders and triangular and square throwaway carbide inserts is highlighted in an eight-page catalog. These tools and edges reduce production costs and increase cutting efficiency.



For complete details on styles, sizes and prices, obtain a copy of Catalog 852C from Besly-Welles Corp., 852 Dearborn Ave., S. Beloit, Ill., or —
Circle Inform-A-Gram No. B29.

Penetrol is covered in an eight-page booklet published by The Flood Co., Hudson, O. The booklet explains in detail how and why Penetrol is effective as a rust preventive, paint extender and reinforcing paint additive. It is of interest throughout the general industrial, automotive, etc. fields. Obtain copies from the company, or —
Circle Inform-A-Gram No. B30.

Increased Production Rate and Tool Life are provided by Lusterized Ledloy cold drawn bar steels. The features and description of Lusterized Ledloy finished steel are found in a new bulletin. Also pictured are typical uses. For further details, get a copy of Bulletin 56 from Bliss & Laughlin, Inc., Harvey, Ill., or —
Circle Inform-A-Gram No. B31.

Barnaby Screw Machine and Turret Lathe Tools are highlighted in a bulletin released by Hamilton Mfg. Co., Inc., 286 Hamilton St., New Haven, Conn. Detailed are inside adjustable gages, rotary stock stops, hinged-shoe bushings, chuck-type floating holders, self closing knurling tools, conventional floating holders and non-releasing tap holders. Also presented is engineering reference data.
Circle Inform-A-Gram No. B32.

There Is No Need for Drawings or Specifications with Reed standardized thread rolls and holders. Rolls for popular thread sizes for both straight and taper pipe threads can be ordered by number. Six stock

sizes of improved single roll holders are also available. Bulletin 1-16 containing a price list and ordering information, is available from Reed Rolled Thread Die Co., Worcester 1, Mass., or —
Circle Inform-A-Gram No. B33.

Quick Detachable Couplers are highlighted in a catalog published by Foster Mfg. Co., Inc., 2850 Gravois, St. Louis 18. In addition to specifications and ordering information for the couplers, diagrammatic layouts illustrating their applications are presented. Also covered are industrial plastic hose, fittings and adapters.
Circle Inform-A-Gram No. B34.

Specifications for Balls of various sizes, grades and in materials ranging from stainless steels to nonmetallics such as ceramic, sapphire and plastic are found in a new brochure. These balls are used for a wide range of industrial applications. For your copy of this brochure, write to Universal Ball Co., Willow Grove, Pa., or —
Circle Inform-A-Gram No. B35.

Aluminum Oxide Cutting Metals, tool tips, throw-away inserts, cylinders and other machine turning and cutting tools are described in a new 12-page catalog. Included are technical data on aluminum oxide, recommended applications and machining practices, dimensions of standard tools and instructions for grinding them. Get your copy of Catalog D-56 from The Metal Carbides Corp., 107 E. Indianola Ave., Youngstown 7, O., or —
Circle Inform-A-Gram No. B36.

A Detailed Phosphating Folder covers the Turcoat line of phosphating and metal protective coating materials. Included are diagrammatical cross-sections of how phosphating works, application photos and a discussion of the use of coating materials as bonds for paints, as anti-friction coatings, etc. Also featured is a phosphating reference chart. Copies of the folder can be obtained by writing to Turco Products, Inc., 6135 S. Central Ave., Los Angeles 1, or —
Circle Inform-A-Gram No. B37.

PORTELVATOR®
The Handy HAMILTON Portable, Elevating Table

A PORTABLE HEIGHT-ADJUSTABLE TABLE
● TRUCK
● WORK BENCH

for DIE TRANSFER
● MACHINE FEEDING
● ASSEMBLY AT BEST HEIGHT IN BEST LIGHT

LIFTING
● LOWERING
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UNOBSTRUCTED PERIMETER
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WORK FROM ANY SIDE

MORE SERVICE for LESS MONEY than ANY Other Unit of Equipment

43 table surfaces
point support

Recent changes and additions to the line provide greater capacities, new flexibility, many bonus features.

Write for NEW, FREE Bulletin P-5604

Address THE HAMILTON TOOL COMPANY,
832 South Ninth Street, Hamilton, Ohio

IT'S A Hamilton Tool
USE IT WITH CONFIDENCE
5604

CIRCLE INFORM-A-GRAM KEY NO. 129

"How to Cure Piercing Headaches" explains the advantages of Wiedemann turret punch presses for short to medium production piercing of flat sheet metal and plate. Specifications are given for the complete line of presses from a hand-operated 7½-ton machine to a 150-ton press. Copies of the booklet which uses brief text and cartoons, are supplied by Wiedemann Machine Co., Dept. 345, 4272 Wissahickon Ave., Philadelphia 32, or —
Circle Inform-A-Gram No. B38.

A Selection from over 700 Different Carbide and Carbide Tipped Tools is presented in Bulletin 56 which is a condensed version of a larger catalog which will be available soon from Nelco Tool Co., Manchester, Conn. Among the items listed with tabular matter and prices are carbide tipped side milling cutters; slab, face and steel end mills; shell milling cutter arbors; true spiral and carbide tipped end mills; and drills.
Circle Inform-A-Gram No. B39.

at rates up to 288 per hour

Five Burr-Blast models available — manually loaded stationary or continuous rotating units and fully automatic in-line types—permit you to pick the right type and size machine to remove fragmentary burrs from finish machined nonferrous or cast iron parts. Simple installation uses normal plant air supply from 60 to 80 psi. Built-in flexibility permits burring a variety of parts on any of the Burr-Blast models.

You also benefit from Modern's experience in successfully blast burring a wide range of part shapes and sizes with every known blasting material including: walnut shells, silicon carbide, steel shot, etc.

Ask for literature describing Modern's Burr-Blast line.

MODERN®
Industrial Engineering Co.
14230 BIRWOOD AVE. DETROIT 38, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 130

The Principles of Air-Gaging with the column Precisionaire are contained in a 12-page catalog. Featured are basic tooling for inspecting internal and external dimensions and conditions, and types and sizes

of adjustable air-gage tooling. Also included are illustrations of single and multi-dimension Precisionaire gage applications. The Sheffield Corp., Div'n 610, Dayton 1, O., will supply copies of Catalog IPC-6-56, or **Circle Inform-A-Gram No. B40.**

Simplify Fluid Power Application with Any-Feed Paks. They provide fine feeds and high traverse speeds. These power Paks are built in four sizes. Bulletin 44200-A showing four oil flow diagrams, oil and electrical circuits, typical machine cycles and base installation drawings is provided by The Oilgear Co., 1598C W. Pierce St., Milwaukee 4, or —
Circle Inform-A-Gram No. B41.

Dies and Machines for Cutting, Perforating, Flash Trimming and Electronic Sealing are featured in a catalog from Western Supplies Co., 2920 Cass Ave., St. Louis 6, Mo. These items are used by the rubber and plastics industries. Each item is illustrated and its applications and features noted. Contact the company for a copy of the bulletin, or —
Circle Inform-A-Gram No. B42.

Duplex Milling and Combination Production Machines are covered in Bulletin S-56 released by The Motch & Merryweather Machinery Co., Machinery Mfg. Div'n, 888 E. 70th St., Cleveland 3. Covered are Model 5-M-1842 bed type milling machine, a production milling and centering machine and duplex milling machines for weight balancing and for long parts. The features of these machines are pointed out and each of the machines is described. Get your copy from the company, or —
Circle Inform-A-Gram No. B43.

A New Net Pricing Schedule has been designed to reduce order errors and save jobbers and end users more than 10% of their pricing time on fasteners. Hexagon head, flat head and fillister head cap screws; square head cup point set screws; and milled studs are covered in the schedule. Given are consumer net prices for package and bulk quantities. Price Schedule 56-C has been released by The Cleveland Cap Screw Co., 2917 E. 79th St., Cleveland 4, or —

Circle Inform-A-Gram No. B44.

"Loose Diamonds" presents information on sizes, uses and terminology of industrial rough diamonds. The illustrated brochure lists the standard categories of the diamonds and describes each. Also given is general information about diamonds. Copies of the brochure can be requested from Diamond Tool Research Co., Inc., 380 - 2nd Ave., New York 10, or —

Circle Inform-A-Gram No. B45.

Flo-Line Solenoid and Master Valves provide versatile, dependable, safe controls for air operation to 150 psi. A bulletin details the basic valve types available, and materials and construction. Also presented are flow patterns and spool options, and circuits. For your copy of Catalog 261, write to Hanna Engineering Works, 1765 N. Elston Ave., Chicago 22, or —

Circle Inform-A-Gram No. B46.

A Low Cost Overhead Conveyor is described and illustrated in a four-page bulletin prepared by Chainveyor Corp., 5618 E. Washington Blvd., Los Angeles 22. Listed are the features of the conveyor and its use. The versatile, flexible conveyor which is fully enclosed and easy to install, runs horizontal, straight up, straight down or upside down. A copy of the bulletin can be obtained from the company, or —

Circle Inform-A-Gram No. B47.

A New 125-Sheet/Min Metal Sheet Feeder is described and illustrated in a six-page brochure. Included is information on operating features, application data, electrical specifications and shipping information. Two large-scale photos show the important mechanical components of the machine. Also presented is a dimensional floor plan showing layout requirements for installation. For copies of the brochure, write to Dexter Folder Co., 330 W. 42nd St., New York 36, or —

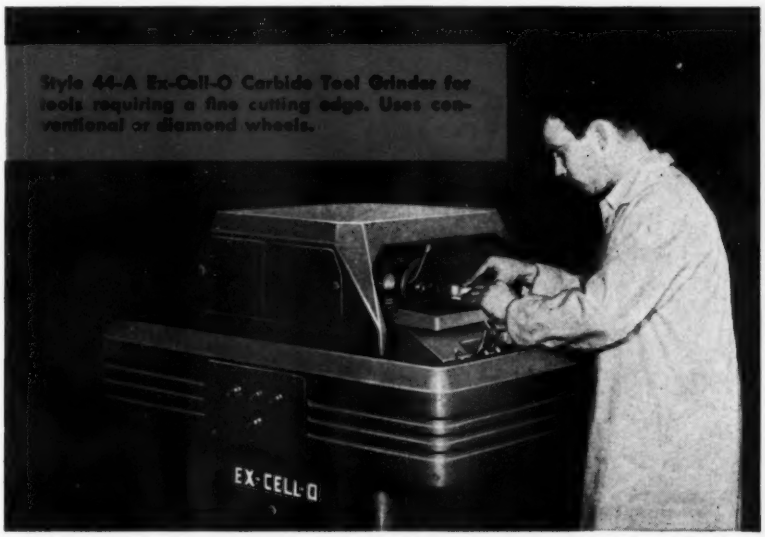
Circle Inform-A-Gram No. B48.

A Line of Low Friction Guide Pin Bushings is announced in Bulletin 15.404 by WW Alloys, Inc., Div'n of Fansteel Metallurgical Corp., 11644 Cloverdale Ave., Detroit 4. These bushings are made of a premium grade of aluminum bronze. They are provided in 26 standard sizes precision machined and in 16 standard sizes rough bored and faced to be finished by the user. Catalog numbers, dimensions and specifications are listed in the bulletin.

Circle Inform-A-Gram No. B49.

Burring, Smoothing and Polishing Operations after dimensional grinding or shaping are handled by Cratex rubberized abrasives. They are available as wheels, points, blocks, sticks and cones. A catalog details their uses, applications, features and operating suggestions. In addition, the various types of rubberized abrasives are illustrated and described. Copies of Catalog 53 are released by Cratex Mfg. Co., 81 Natoma St., San Francisco 5, or —

Circle Inform-A-Gram No. B50.


Style 44-A Ex-Cell-O Carbide Tool Grinder for tools requiring a fine cutting edge. Uses conventional or diamond wheels.
EX-CELL-O

FAST WORK ON A WIDE RANGE OF TOOL SIZES

There's much you'll like about Ex-Cell-O Tool Grinders.

You'll like the power and smoothness made possible by the balanced inbuilt motor spindle that rotates in Ex-Cell-O Precision Bearings.

Ex-Cell-O Tool Grinders, such as Style 44-A pictured above, grind single point tools of carbide, cast alloys and high speed steels to long-lasting, sharp edges. Grooved, hardened steel plates in the tables resist wear and provide a good bearing surface for the tools. All Ex-Cell-O Grinders are double-end models; all use steel back wheels and have large, easy-to-adjust tool rest tables and coolant equipment.

Ex-Cell-O has a tool grinder to fit all types of operations. Why not write Ex-Cell-O or call your local Ex-Cell-O Representative?

EX-CELL-O CORPORATION XLO
DETROIT 32, MICHIGAN

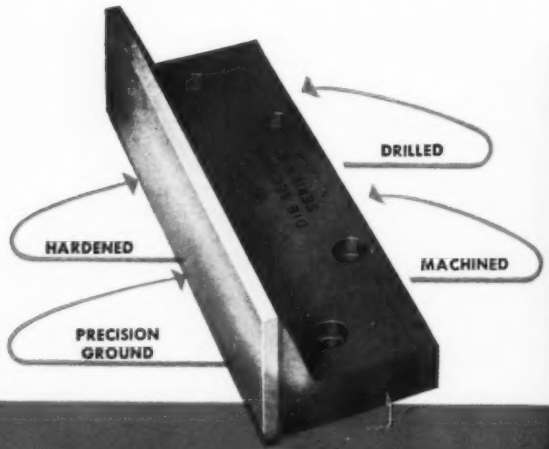
EX-CELL-O FOR PRECISION

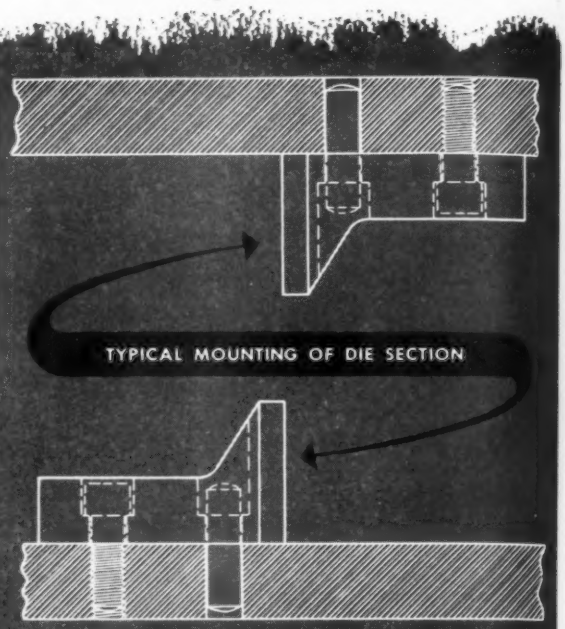
MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

56 - 53

CIRCLE INFORM-A-GRAM KEY NO. 131

Reduce Your Die Building Time...





Standardized Die Sections

Standardized Die Sections manufactured by R-B eliminate all of your machining, drilling, hardening and grinding. For, these die sections are entirely prefabricated and ready for mounting on your die shoes . . . they will substantially reduce your die building time.

Series A, B & C die sections have cutting edges of tool steel which are hardened and precision ground. Bases are of mild steel to permit drilling of dowel pin holes.

Series AA, BB & CC die sections are not hardened, have wider lands and are of the same general construction as series A, B & C. These extra wide lands permit contouring before hardening. Die sections in both series are available in various lengths and heights.

TOOL STANDARDIZATION is the basis for saving production time. With R-B you get the accepted standard of the sheet metal industry—in standard design features that save in engineering, die construction and operation.

Use R-B Engineering Service for Your Piercing Problems

RICHARD BROTHERS PUNCH DIVISION
ALLIED PRODUCTS CORPORATION
DEPT. 89 • 26476 CAPITOL AVENUE • DETROIT 39, MICHIGAN

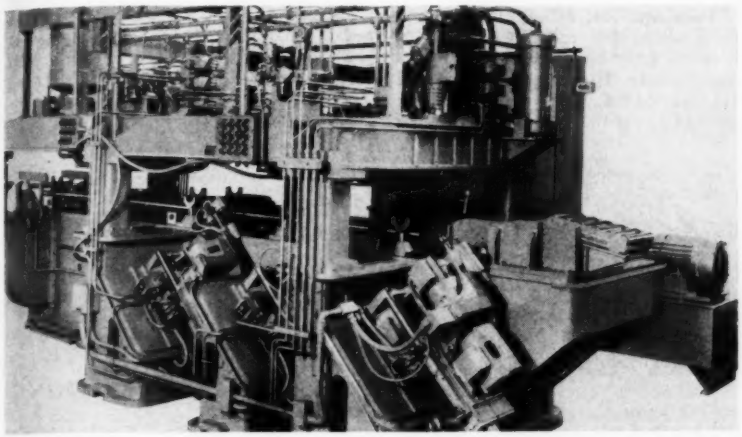
CIRCLE INFORM-A-GRAM KEY NO. 132

Automated Machine Processes Rear Axle Housings

A new, completely automatic machine, called the "LaSalle Line-O-Matic", has been designed to be mounted into the processing line, and perform its series of operations, completely—automatically.

This new machine, developed by LaSalle Tool, Inc., Detroit 34, processes rear axle housings for both passenger cars and trucks. Any one of 3 different housings can be processed, on this one machine, with no additional locators being required.

The machine handles a welded assembly, on which there has been no previous machining. It not only automatically pierces, extrudes, machines, and assembles, but, in addition, automatically loads and unloads.



When the part is automatically loaded into the machine, from the conveyor line, it trips a limit switch, which in turn initiates the cycle of the machine. The part is shuttled to the next station and lifted into the fixture, after which the shuttle returns.

The part is located up-and-down from 4 points on the banjo face. The endwise location is taken from 4 points inside the banjo. Angular location, as well as up-and-down clamping, is taken just outside the banjo on the tube. All locating surfaces are dirt and chip free, because the locating surfaces are upside down.

At the first work station drawing compound is automatically applied and then the drain hole is hydraulically pierced and extruded.

At the next station, the drain hole is tapped for a ⅜" pipe plug; and, the vent hole is drilled for a ¼" pipe plug.

At the next work station, Permatex is applied to the drain hole. Incidentally, there's a unique built-in system on the machine for metering and measuring the exact amount of Permatex required. Also, at this station, both sides of the vent hole are deburred.

At the next station, the machine automatically feeds and runs the ⅜" pipe plug into the drain hole—to 30 ft-lbs torque. The supply of pipe plugs is hopper fed. In addition, the vent hole is tapped for a ¼" pipe plug.

At the last station, the rear axle housing is turned over, and unloaded onto the conveyor line. And, every operation has been performed automatically.

Boring Both Ends of Steel Tubing

A new automated 5-station in-line transfer type, double end precision boring machine utilizing modular construction and a unique inclined hopper feed mechanism and overhead transfer bar arrangement has been designed for machining steel tubes.

The machine, built by Expert Automation Machine Co., 17144 Mt. Elliott Ave., Detroit 12, flares, faces, chamfers, rough and finish bores both ends of various lengths of tubular steel automotive steering columns at a rate of 414 tubes/hr at 80% efficiency.

The hopper feed has an air-powered mechanism that feeds tubes two at a time to an air-powered oscillating overhead transfer bar arrangement. A rack type unloader removes the parts from the machine. Adjustments are provided for the machining heads and hopper feed to permit the handling of 32", 33" and 34" long tubes having a diameter of 1½".

The three machining stations utilize modular construction, each having identical cast wing bases. A screw conveyor chip trough that carries chips along the length of the machine and deposits them in containers is cast in the machine base.

Double End Boring of Differential Housing Flanges

Precision borizing on both ends of an automotive differential housing is performed by a recently developed Bore-Matic.

The machine, designed by The Heald Machine Company, Worcester 6, Mass., is capable of taking the steel workpiece, over 4' long, holding it between two angle plate fixtures and stabilizing it at its midsection by a horizontal platen.

The left hand angle plate is secured to the base. The movable right hand angle plate is hydraulically actuated, clamping the workpiece flange faces. Locating holes in flange face receive round and two-way locating pins.

Important feature of this machine is the fact that while boring operations are being done simultaneously 50" apart, tolerances and concentricity are held to close limits. Surfaces borized are bearing and oil seal diameters and adjacent chamfers. With 0.015" stock removal, diameters are held to a tolerance of 0.002".

Another notable feature is the use of feedout tools to eliminate tool drag line or spiral normally present in one-way boring operation. Air operated push rods working through hollow boring head spindles advance tools to correct position for in-boring and retract tools prior to table run-out, eliminating the necessity of boring out to avoid drag line.

A hydraulic unit mounted at the rear of the machine provides all power for the horizontally opposed slide units which carry tooling to the workpiece. Except for loading operations, all machine functions are controlled from a pushbutton station.

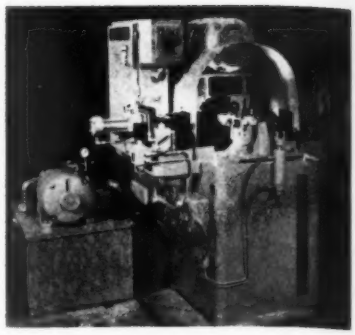
Special Machines

New Machine Rolls RH and LH Threads on Bicycle Cranks

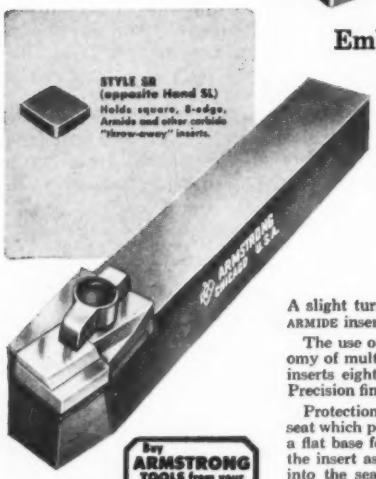
Both right and left hand threads can now be rolled on bicycle cranks in a single, automatic cycle on a new Sheffield-Murchey machine, at a rate of approximately 120 parts/hr, including load and unload time.

Manufactured by The Sheffield Corporation, Dayton 1, Ohio, the machine consists of a floor-type base on which are mounted two Precision-Rol units operated by a hydraulic sub-slide assembly.

The crank is loaded between centers and clamped in the work holding fixture. Next, the operator pushes a button to actuate a special oversize Precision-Rol to roll the 15/16"-24 right hand thread. After the unit retracts, the standard No. 875 Precision-Rol attachment comes into position for rolling the 7/8"-24 left hand thread to complete the automatic cycle. The right hand thread rolls are extra large to clear the driving lug on the bicycle crank.



New
ARMSTRONG
Armide CARBIDE INSERT
TOOL HOLDERS



Embody...Convenience, Economy Simplicity and Strength based on these superior features:

- IMPROVED CLAMPING METHOD — speeds indexing of inserts.
- REPLACEABLE SEAT of Hardened Tool Steel — protects shank and provides flat base to prevent damage to inserts as they are clamped in position.
- SHANK of Heat Treated Alloy Steel — gives extra strength and rigidity.

A slight turn of a single screw permits rapid indexing of the ARMIDE insert — reducing down time to a minimum.

The use of ARMIDE "throw away" inserts provides the economy of multiedged inserts — triangular inserts have six, square inserts eight cutting edges. These are available in Utility or Precision finish and in three grades of ARMIDE: 350, 370 or 883.

Protection to the shank is given by the replaceable tool steel seat which prevents wear and damage to the shank and provides a flat base for the insert reducing the possibility of damage to the insert as it is clamped in place. A relief groove is ground into the seat providing clearance when a dulled insert with "built up" edges is turned over.

ARMSTRONG ARMIDE Carbide Insert Tool Holders are furnished in two styles and three sizes. Complete data on these tools is given in Bulletin CIT, mailed on request.

Buy ARMSTRONG TOOLS from your Industrial Distributor

Write for catalog

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
5220 W. ARMSTRONG AVENUE CHICAGO 30, ILL.

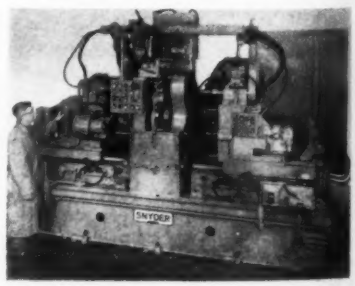
CIRCLE INFORM-A-GRAM KEY NO. 134

Trunnion Type Automatic Machine Bores & Assembles

A new 6-station trunnion-type, two-way precision boring machine has been designed that performs both machining and automatic assembly operations. This unique machine, which has six precision boring spindles, utilizes a rotary hopper feed to direct split babbitt bushings to a plunger for press-fit assembly into the part at the 4th station. Deflection of the part, during the assembly operation, is prevented by a hydraulic stop that advances to within 0.002" of the back face of the part.

The machine, built by Snyder Tool & Engineering Co., 3400 East Lafayette, Detroit 7, machines die-cast electric motor end shields of 5-11/16" dia and assembles a bushing in the center hole at a production rate of 350 pcs/hr at 75% efficiency.

All machining operations occur simultaneously with parts in the five machining stations. At each index, a part is unloaded from the 1st station and another part manually loaded in and chucked before the cycle start button is pressed. The



machining cycle on the hydraulically operated, electrically controlled machine is entirely automatic.

The new Snyder trunnion-type two-way precision boring machine occupies a floor space about 8' by 14' and is 8' high overall. Air-oil mist lubrication is provided for the precision boring spindles which are motor driven through V-belt drives. Indicator lights on the control panel indicate the operating condition of each machining function.

Standard Units Make Up Special 47-Spindle Machine

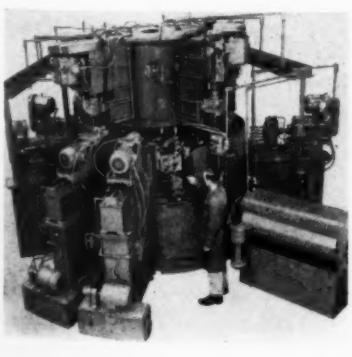
Forty-seven distinct operations are performed automatically on one-cylinder or two-cylinder refrigeration compressor housings by a new high production machine that utilizes an 84" dia table to process 120 parts/hr.

The unit-type machine tool, manufactured by The Morris Machine Tool Company, 933-38 Harriet St., Cincinnati 3, eliminates model change-over problems by incorporating standard Morris production units. These are mounted on a basic center column machine equipped with an 18-station hydraulic indexing table.

The total of 47 spindles are mounted on three 8" way type units, six No. 2 Cam-Matic drill units and eight Air-Oil-Matic drill units. They are used to mill, drill, counterbore, spot face, bore, ream and tap housings.

"Unit-type" construction permits fast, easy re-alignment of the machine for product model changes, for completely new models, or for other types of products within the size limits of the machine.

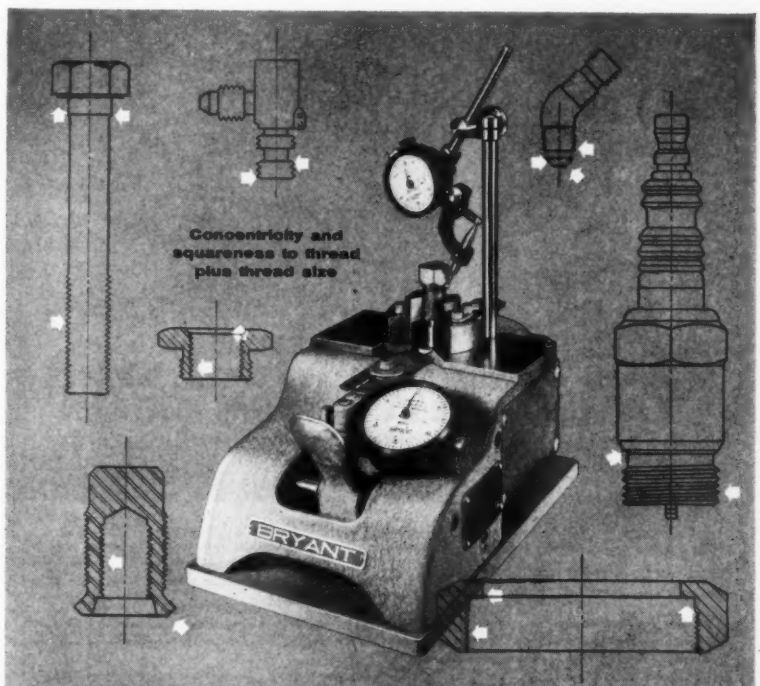
Easy access to all tools is provided by the efficient mounting of the individual units. Vertical units are mounted on the stationary center column. Horizontal units are mounted on pedestals attached radially to the cast iron base.



Operation is completely automatic. The machine operator merely loads unfinished pieces into air-powered clamping fixtures and unloads completed parts. The fixtures, which accommodate either one-cylinder or two-cylinder housings, utilize an expanding arbor to locate the part with respect to a previous roughing operation.

Each of the standard Morris drill units has independent feeds and speeds, permitting adjustment without affecting the entire machine. Preset for correct alignment, the individual unit performs the same operation each time the table indexes. All units are controlled simultaneously through an integrated electro-hydraulic system.

The Morris Cam-Matic drill units provide electrically controlled, mechanically driven drilling and allied operations. An electric clutch simplifies construction, eliminates troublesome shear pins. The clutch slips when excessive thrust is required, preventing damage to workpiece or tool.



You can check all these with a Bryant Gage!

These are just a few of the checking problems that Bryant Gages can solve — accurately and quickly. For a prompt solution to your checking problem, mail the coupon below.

Bryant Gage and Spindle Division P. O. Box 620-F Springfield, Vermont, U. S. A.

Gentlemen: ☐ I am enclosing a print of my part. Please send me a quotation. ☐ Please send literature and prices on the complete line of Bryant Gages. ☐ Please have Bryant representative call.

Name _____ Street _____

Title _____ City _____ Zone _____

Firm _____ State _____

CIRCLE INFORM-A-GRAM KEY NO. 135

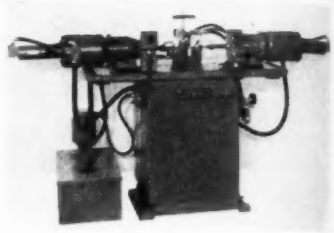
Special Machines

NEW AUTOMATIC CENTERING MACHINE

A new machine, designed to perform a centering operation on such parts as motor camshafts and crankshafts has recently been developed for high rate production.

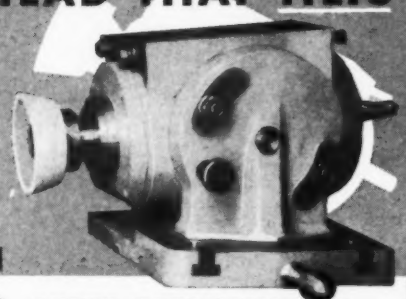
The machine built by the Govro-Nelson Co., 1933 Antoinette, Detroit 8, incorporates two opposed Govro-Nelson automatic drilling units, and is simple to operate. The operator merely loads the part into a fixture and depresses the start cycle switch, whereupon the work is automatically clamped, centered at both ends and unclamped, ready for the operator to remove. The production rate is approximately 360 pcs/hr.

By making minor changes, the machine can be readily adapted to a variety of parts.



HERE'S A HEAD THAT TILTS

and Yours Will Nod, Too When You See What You Can Do With This One



POPE SUPER PRECISION 1 HP, 3600 RPM MOTORIZED TOOL AND CUTTER GRINDER CLEARANCE ANGLE SWIVELLING HEAD

With Angular Adjustment In A Vertical Plane

Give this versatile head the nod and save time and money these seven ways:

1. You can use cup wheels for practically all clearance angles and thus produce a cutting edge on tools that lasts longer because it is stronger.
2. You can keep the tooth rest on the center line of the cutter for practically all grinding on centers or in the work head.
3. You can grind most cutters and reamers all over with a single set-up using the swivelling table and Pope tilting head.
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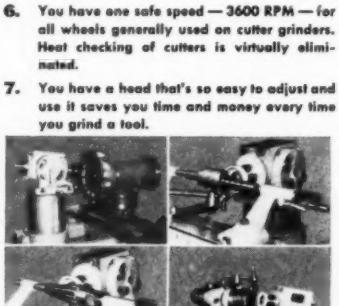

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CIRCLE INFORM-A-GRAM KEY NO. 136

AUTOMATED INDEX WELDER POSITIONS PARTS FOR WELDING

A new automated 7-station rotary index projection welding machine designed for accurately positioning and welding nuts or brackets to surfaces of production parts has recently been introduced.

The machine developed by Expert Welding Machine Company, 17144 Mt. Elliott Ave., Detroit 12, features a stop and start cam drive mechanism that controls index and weld sequences, bowl feeders equipped with hopper feed tracks, a transfer device for delivering weld nuts to the projection welding guns and a unique mechanism for projection welding brackets to production parts. An air-powered unloader mechanism automatically removes the finish-welded assemblies from the machine and deposits them on a conveyor. The motor driven machine is electrically controlled and air operated.

The model illustrated projection welds two tee nuts, three weld nuts, and a steering stop bracket to automotive suspension arm assemblies at a rate of 400/hr. Parts to be welded are manually loaded into the fixture at Station No. 1 at the front of the machine. Parts are then automatically indexed to idle station No. 2.

In the No. 3 station a vibratory hopper feeds the tee nuts to two hopper feed tracks from which two horizontal air-operated mechanisms automatically transfer the tee nuts to

spring clips located on the electrodes of the welding guns. Two overhead air-operated welding guns then move downward, correctly positioning the tee nuts and welding them in place. An overhead air-powered hold down cylinder holds the part in place during this operation.

In the No. 4 station, a steering stop bracket is manually loaded into the fixture. Three weld nuts fed through two vibratory hoppers and three feed tracks are projection welded to the part in the No. 5 station in the same way as the tee nuts in station No. 3.

At the No. 6 station, the steering stop bracket is projection welded to the outside edge of the suspension arm. An overhead hold down and locator cylinder accurately locates this bracket on the part. Two pinch guns, each one operated by a lever arrangement and an air cylinder, move upwards from below the index table and weld the bracket to the outside surface of the suspension arm assembly.

The part is automatically unloaded at the No. 7 station by two air-operated unloader arms that move radially inward through the fixture. The air-powered unloader mechanism then pivots, moving the arms upward and strips the finish-welded assembly from the fixture. The assembly then slides outward and downward from the machine to a conveyor.

Basic Components Make Up Special Drilling Machine

This new multiple operation, index table machine was built to finish jet nozzle bits. The finished part functions as a bracket to hold one of the cutting heads on an oil well rock drill.

Consisting of 5 stations, the machine, built by Baker Brothers, Inc., Toledo 10, Ohio, operates as follows: load two parts, center drill, drill, counterbore, ream and recess. Each fixture holds two parts, and identical operations on the two parts are performed at every station. The production rate is 123 parts/hr at 100%.

Fig. 1. The unmachined part (left) . . . and the completed jet nozzle bit (clamped, at right). 123 pcs/hr is the production rate for this Baker Brothers machine.

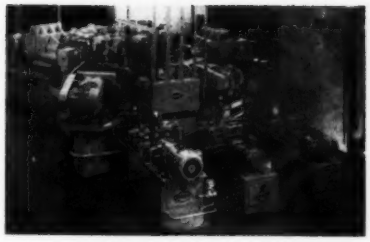
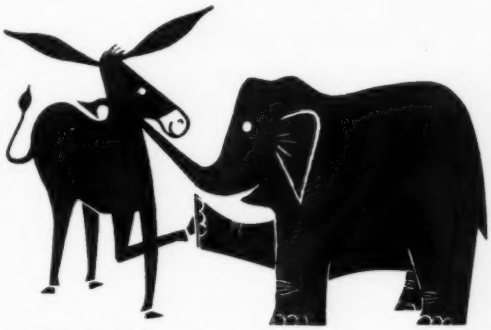


Fig. 2. The operations performed by this 5-station index table machine are: load two parts, center drill, drill, counterbore, ream and recess.

While specially designed to produce these jet nozzle bits, this index-machine is composed of Baker Basics — versatile hydraulically operated standard machines that can be retooled for changes in product or production methods. For example, they can be used in battery, as illustrated, or used singly. Consequently, automation is feasible even on lower production runs, as they are adaptable to change.



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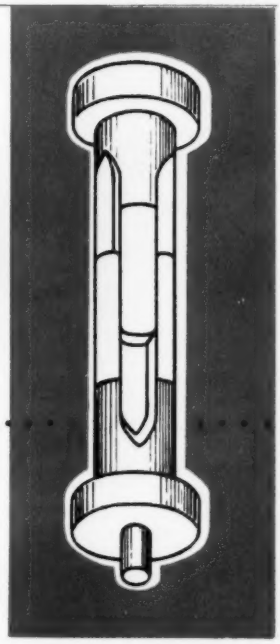

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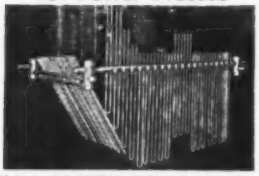

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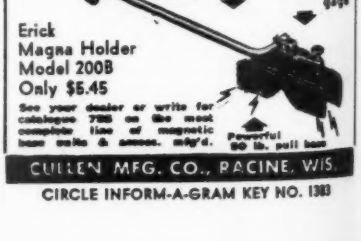

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It will provide the means for meeting today's exacting dimensional control standards. Only through more frequent periodic inspection and calibration of gage blocks can wear be determined so that block tolerances can be computed to enable the user to measure exact dimensions. The procedures and facilities used are so practical that even the smallest company using gage blocks can put the program into effect.

Here is all the equipment needed to make a quick inspection and accurate calibration of your own gage blocks in the shop.

The program provides a free, four-day, comprehensive training course at the DoAll Technical Institute, Des Plaines, Ill. The course combines both classroom sessions and laboratory practice. The classroom sessions are concerned with orientation, principles and techniques of interferometry, dimensional controls for tolerances, preparation and interpretation of calibration records, effects of temperature, observational error, etc. In the laboratory, actual procedures, operation of instruments, and recommended methods of calibration are practiced. For this practical training work, each trainee is requested to bring a set of his company's own gage blocks. At the conclusion of the course, he will have made a thorough inspection and recalibration of these gage blocks, making up a report recording of the actual dimension of each block.

DoAll's procedures in checking gage blocks for flatness and wear are designed to employ simple, inexpensive equipment. A monochromatic light source, optical flats, and a deburring stone comprise the basic equipment plus some minor accessories for cleaning and wiping blocks. Instructions for using this equipment are complete even to the point of providing charts against which fringe line readings can be compared for a rapid determination of flatness of the gaging surfaces. An out-of-flat condition signals wear and consequent need for recalibration.

Additional equipment needed for calibrating Grade "A" and Grade "B" gage blocks are an electronic comparator and a set of "master" blocks.

In selecting the equipment and the procedures to be followed, DoAll made exhaustive tests to certify the program's practical application by both large and small companies using gage blocks.

For those gage block users who do not elect to send their quality control men to the training course, The DoAll Company has published a manual of metrology entitled "How to be Your Own Bureau of Standards" written in nontechnical language and illustrated to reveal the procedures and the equipment required to set up a program of gage block inspection and calibration.

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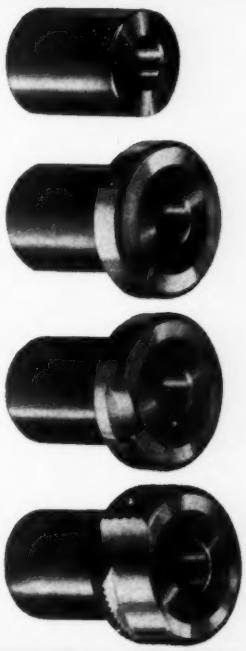

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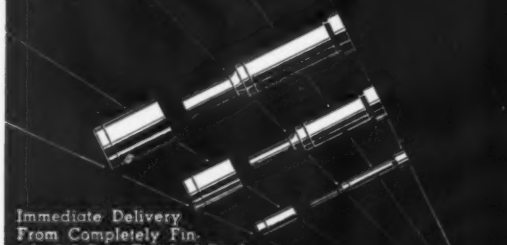

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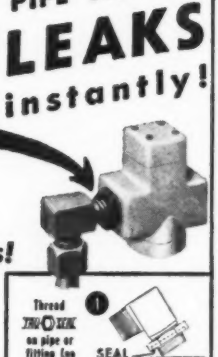
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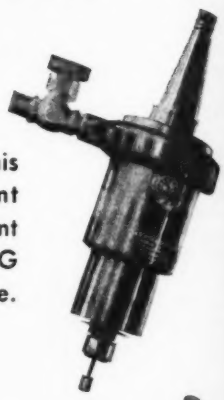

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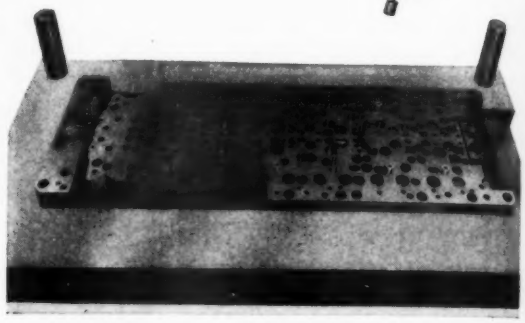

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. . . Small Firms From Page 76

shear, the parts being dropped into a small container.

The three parts (rights, lefts, and pins) could then be dumped into separate hopper feeders which would properly orient each and feed them at proper intervals down a track into an air-operated fixture. The fixture is tripped by another limit switch. After these parts are properly oriented and clamped another limit switch trips a mechanism to release a pin which feeds down the track and rolls into position into a groove where it is staked into the hinge by an air cylinder operated by either a limit switch or relay. Pressure on the back end of the fixture actuates a limit switch which retracts the ram and opens the fixture. The finished assembly is then ejected by air or a mechanical finger. The assembly drops down a chute onto a belt conveyor which moves it into another hopper feeder for the packaging operation.

This station uses three feeders, two for the hinge assemblies, the other for feeding six screws. Paper envelopes are automatically fed from the side of the mechanism into a vertical up-ended position with the flap up. The hinges are fed down tracks in a closed position, released one at a time and dropped into the waiting bag. Screws, six at a time, are released and dropped into the bag. The flap of the envelope is folded into position and stapled. The loaded envelopes are then moved along a track into a carton for the last packing operation.

The cost of this setup was estimated by several vendors at between $3000 and $3500. This estimate includes all the standard parts and fixtures, design and fabrication of auxiliary units using a combination of plant personnel and facilities and the services of the vendor's sales engineer. Only one operator is now required to service this system. Consider the following advantages which could logically result from this changeover.

Manpower requirements: Reduced from six to one.

Production: Increased upwards to 400% over previous daily rate.

Quality: Considerably increased.

Scrap: Negligible.

Equipment cost comparisons: $3500 additional cost.

Space savings: Tighter grouping of equipment permits up to 50% savings, and allows additional space for other operations.

Intangibles: Many worthwhile side effects for plant and personnel.

The advantages of automation for the small manufacturer should be quite obvious from this simple example. Where the operation becomes complex, the savings increase proportionally. It is important to call attention to the role product redesign pays in automation. No program can be complete without it. In fact, sharp designers can materially reduce costs through careful analysis of design in terms of newer and cheaper processing methods without any appreciable change in the basic process. Such methods cut out expensive steps and make the product cheaper to manufacture. This permits competitive pricing and helps place a manufacturer well ahead of his competitors.

To further emphasize the many advantages automation has for the smaller manufacturer, take the following operation: Tapping a ½" x 28 hole in a steel disk 3/16" in diameter, ½" thick, 1020 steel, with a ½" - 28 NF straight, 2-fluted tap. This operation was originally performed on an inexpensive Delta drill press with a production of 1750 pcs/hr. By adding a hopper feed device, a Bellows DFE-120 ½ hp feed, indexing and holding fixture operated by a Bellows BM 5-25 air motor, production was automated and output increased to 25,000 pcs/hr. In this setup no change was made in the basic equipment used on the original operation. An air motor was used to clamp the parts which were fed by

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gravity to the indexing fixture. An electrically controlled power feed was installed to feed the spindle which is equipped with a continuous cycling control. As the fixture locks, it actuates the spindle. As the spindle retracts, it actuates through mechanical linkage the air motor which releases the part. Here's an operation which increases production 33%, all for less than $1000.

A more striking example of how small manufacturers can apply catalog components to standard production equipment in order to automate their production is the Synthane Corporation at Oaks, Pennsylvania. This plant fabricates and laminates plastic parts and has already converted over 100 pieces of equipment to automatic operations through the use of air motors, automatic timers, and other air devices. One typical operation, cutting the radius of a 3½" diameter laminated plastic textile bobbin head, putting a bevel on the edge of a 1¼" center hole, and cutting the hole out was previously performed by three separate lathes. Through the use of air powered equipment these operations are now being automatically produced at a rate 75% faster on one lathe than the combined output of the three lathes previously required. Considering the added space savings, reduced manpower and higher production — this is a rather profitable application.

These and many more are examples of what can be done with automation in small plants to help aggressive management stay on top of the heap, maintain a healthy competitive position, reduce manpower requirements, increase capacity, cut down on scrap, improve earnings and customer relations. Whether it be the automation of a single piece of equipment or a whole line, no small manufacturer need feel afraid to investigate the potentialities of automation in his plant. The cost of automating standard tooling is considerably below what it would cost to replace it with special purpose inflexible equipment. The advantages are so great that the smaller plant will be hard pressed to stay in business if it lets its competitor automate while it does nothing.

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Selas Corp. of America has organized its staff of research engineers into four basic laboratory teams. These teams are designated Applied Research, Scientific Research, Customer Inquiry Research and Metallurgy. Supporting them are chemical and ceramics laboratories, a group of laboratory design engineers and a pool of laboratory technicians.

Norton Creates New Divisions

Three new divisions were created in a recent reorganization by Norton Company. They are: the Abrasive Division, headed by John Jeppson as vice president and general manager; the Refractories Division, with William G. Fallon as general manager; and the Electro-Chemical Division, headed by Howard J. Daly as vice president and general manager.

This brings the number of divisions within the company to six.

As a result of the reorganization, two other posts have been created. Ralph M. Johnson, formerly vice president in charge of sales of abrasives and refractory products, is now vice president and director of sales, responsible for giving sales and distribution guidance to the general managers of the new divisions. Mr. Jeppson is now also vice president and director of manufacturing, responsible for giving production assistance and guidance to the other two new division chiefs.

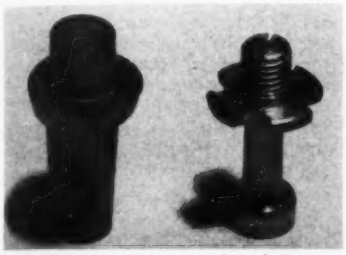
TIPS ON MACHINING MOLYBDENUM

by Errol L. Palmer

FANSTEEL METALLURGICAL CORP.
North Chicago, Illinois

THE MACHINING CHARACTERISTICS of molybdenum cannot be compared easily to those of other metals. Perhaps the nearest comparison which can be made is SAE 1040 or 1045 steel which has been heat treated to a hardness of 30 Rockwell C. Such a material would have machining characteristics that are generally similar — but only generally similar to those of molybdenum.

Molybdenum machines with the crumbling chip which is characteristic of hardened SAE 1040 steel. While it is possible to machine molybdenum with high speed steel tools, tungsten carbide tools are recommended. Very satisfactory results can be obtained with Grade 2A5 Vascoloy-Ramet tools.



Molybdenum insert machined from forging.

Turning and Milling

For inside and outside turning, tools should be ground to standard angles except that a top rake of approximately 30° should be used. Speeds up to 100 sfpm, with a depth of cut up to ⅛" are satisfactory for rough turning. The feed should be 0.015 ipr. For finishing work, speeds to 50 sfpm with a depth of cut of 0.005" to 0.015" and a feed of 0.005 to 0.010 ipr should be used.

It is very important in turning that the depth of the cut always be greater than 0.005" or the cutting tool will wear very rapidly.

If lubricants are not used, tool wear will be excessive and the molybdenum will tear or chip in cutting. For both roughing and finishing cuts it has been found that a mixture of one part chlorothene* and four parts of a nonsulphur base cutting oil make a highly satisfactory lubricant. Chlorothene is similar to carbon tetrachloride, but less toxic. Unmixed cutting oils are not recommended as a lubricant as they shorten tool life and make it difficult to hold close tolerances and fine finishes.

Chipping of molybdenum can be further minimized by making certain that the work is firmly chucked, the tools rigidly supported, and the ma-

Molybdenum cathodes machined from seamless tubing.

*The Dow Chemical Company.

Honing a one microfinish surface on the ID of a machined molybdenum rod.

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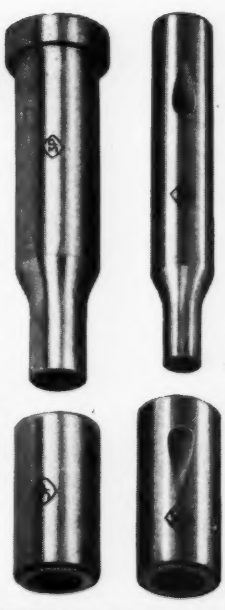

PORTER PRECISION PRODUCTS
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chines sufficiently powerful and free from chatter or backlash.

Face milling is quite difficult, but may be accomplished when necessary by the use of carbide tipped cutters and with the lubricants mentioned. The speeds and depth of cut should be similar to those used in lathe turning, except that the depth of cut should not exceed 0.050".

Stock heavier than 0.090" thick should be edge machined rather than sheared.

Close tolerances on plate stock can be best accomplished by rough edge machining and then grinding. Edge machining should be done on a milling machine with carbide tipped cutters, and not on a shaper. When edge machining, a strip of ⅛" thick steel should be placed on each side of the work and the steel should be cut right along with the workpiece.

Drilling, Threading and Tapping

Standard ground hss drills should be used for drilling molybdenum. For best results the drills should be sharpened frequently. It is important to maintain a steady heavy pressure on the drill. The speed should be 30 to 35 sfpm, with a feed of at least 0.003". A premium grade cutting oil should be used for all drilling, tapping or threading. If difficulty is experienced in tapping or threading, the addition of graphite to the cutting oil will help. In tapping, a tap drill should be selected that will provide a thread depth of not more than 60 to 70% of a full thread or the molybdenum will chip. Rethreading or retapping is difficult, and should be avoided.

Molybdenum can be roll threaded very easily and this method is recommended over thread grinding or chasing whenever possible. Conventional roll threading methods can be applied to molybdenum. The only precaution to bear in mind is that the molybdenum must not be below room temperature.

Grinding and Honing

In grinding, molybdenum behaves in a manner comparable to cast iron. Wheels of 60-grit aluminum oxide can be used if care is exercised, although silicon carbide wheels will do a better job, as they have less tendency to laminate the material. For most work, 60-grit silicon carbide wheels are satisfactory. Finer finishes are possible with 80-grit wheels. Wheels of a grit finer than 80 tend to load rapidly and require frequent dressing. The speeds and feeds recommended by the wheel manufacturers should be followed. For cylindrical grinding, the work speed should be 250 to 300 sfpm, and the depth of grind not more than 0.0002".

For best results, molybdenum should always be ground with an excess of coolant. It is important that the coolant be under pressure at the point of contact between the wheel and the work.

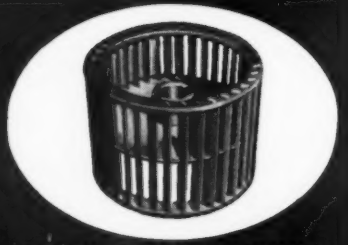
A one or two microfinish surface can be easily obtained on molybdenum by honing.

The Fansteel molybdenum ordinarily supplied is readily machinable as outlined above.

Cost-Cutting FACTS from Production Aids

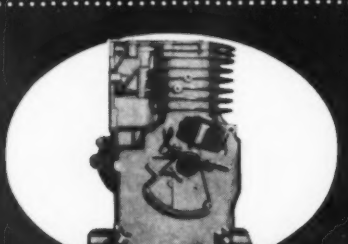
6,000 MOUNTING BRACKETS PER HOUR!

These mounting brackets for gasoline tanks were blanked and extruded in one die, from .074 stock, at the rate of 6,000 per hour! Progress through Automation — from Production Aids!



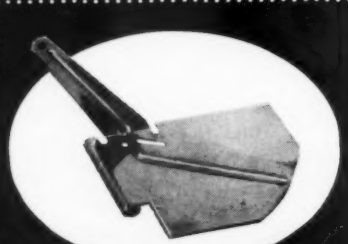
BLOWER FAN MACHINE CUTS COST IN HALF!

Specially designed blower fan machine combines assembly and straightening blowers into single operation — saves 50% in cost for nationally known manufacturer of heating equipment!



8.7 MOTOR BLOCKS PER MINUTE!

A special machine was engineered for a leading producer of single cylinder gasoline engines. It permits 8.7 motor blocks to be machined per minute — allowing a production increase of up to 60%.



SINGLE DIE DESIGN REDUCES COST 85%!

By simply designing one die to replace dies previously used, the cost to complete this air governor was reduced from 22 cents each to less than four cents each! P/A will find the right way!

WHAT'S YOUR PROBLEM?

If you have a job that calls for high-speed die work or automation, Production Aids is staffed to provide you with top-notch service, speed and sound engineering design. Write or phone today.

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Phone: 6-4821

Progress through Automation

CIRCLE INFORM-A-GRAM KEY NO. 144

Intricate, Deep Cavities Formed by New Method

Electroforming, a relatively new method for making precise, intricate deep plastic mold cavities, offered by Carmin Laboratories, Inc., 104-14 S. Fourth St., Brooklyn 11, N. Y., offers numerous advantages. Among them:

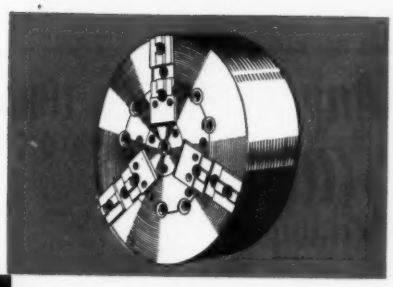
Danger of damage to cavities during mold downtime is eliminated because the nickel does not rust or oxidize.

The nickel is not attacked by molding lubricants.

No polishing need be done to the interior of the cavities. There is no porosity nor other surface defects.

Electroforming lends itself where hobbing or other machining methods can not be performed, such as for molds for precision gear cavities, long, narrow shapes, and where exacting surface designs and textures are important.

SKINNER
POWER CHUCKS



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Write for free catalog on Skinner power and manually operated chucks and accessories, and for free showings of film "Chucks and Their Uses".

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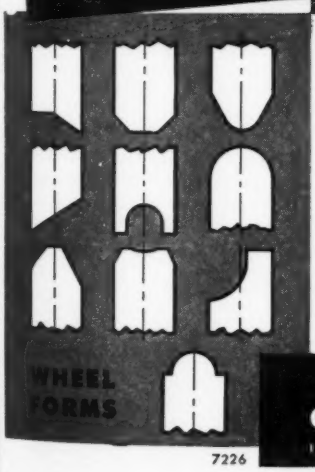
Precision Dress Grinding Wheels to ANY FORM IN ¼ THE USUAL TIME



7226

The Perfex TANGI-MATIC Dresser is a self-contained precision tool built by an organization of master gagemakers for high precision work.

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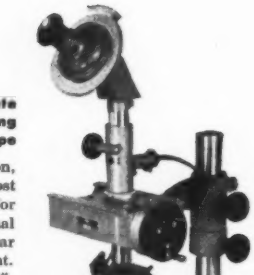
Coordinate Measuring Microscope

High precision, low cost instrument for 2-dimensional linear measurement. Range 2" x 2", reading to 0.0001".



Cut rejects, speed production

Fast, reliable readings to 0.0001" with Gaertner measuring microscopes

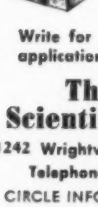
Precise, versatile, easy-to-use Gaertner measuring microscopes assure positive, direct measurement of precision parts. You see clear, sharply-defined images. No physical contact to distort or injure object being measured. Enjoy new production savings with Gaertner optical instrumentation. Write for complete data on the Gaertner line of industrial microscopes.

Toolmakers' Microscope

Ultimate in measuring microscopes. Range 2" x 4", reading to 0.0001", angular measurement to 1 minute.

Micrometer Slide Comparator

Reliable, low cost instrument for linear measurement. Ranges up to 4", reading to 0.0001" or 0.00005".



Filar Micrometer Microscope

High quality, low cost instrument for extremely precise measurements. Range 0.08", reading to 0.00002".

Write for Bulletin 161-54 showing applications, models, specifications.

The Gaertner Scientific Corporation

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CIRCLE INFORM-A-GRAM KEY NO. 1461

Anything . . . in THROW-AWAY *INSERTS*.

CARBIDE, CERAMIC and OXIDE

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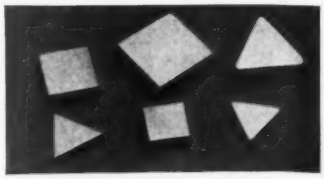
Throw-Away Inserts, all Sizes and Types in any quantity -- Our Specialty



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Cutting Tool Engineers and Manufacturers

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Developed by TOOL MAKERS *for* TOOL MAKERS

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Permits fast, precise positioning of workpiece from ONE SET-UP. No unclamping and reclamping on your standard vertical mill equipped with ADVANCE Cross-Slide Rotary Table.

30 Seconds Accuracy

ADVANCE 15" ROTARY TABLE

This rugged, precise tool is designed for all types of work requiring rotational accuracy. Its maximum speed and precision, and minimum maintenance fills the need for a precision unit at a moderate price.

Full details on request.

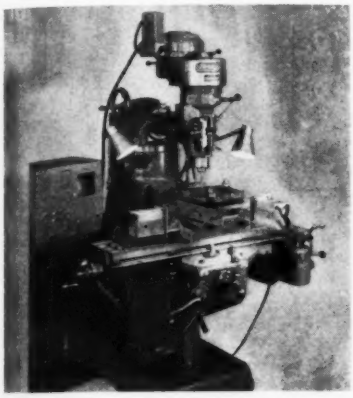
MORRISON ENGINEERING COMPANY
917 West Lake Street, Dept. AI, Chicago 7, Illinois

CIRCLE INFORM-A-GRAM KEY NO. 1463

POSITIONING TABLE IDEAL FOR LIGHT MANUFACTURING

A new lightweight, low cost Binotrol automatic positioning table that is ideal for repetitive runs has been developed for use in light manufacturing and small machine shops.

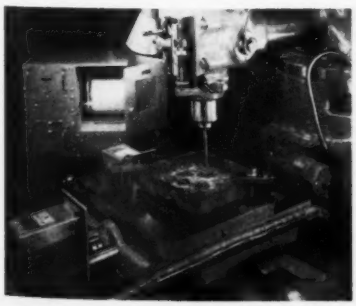
The complete unit controls a 10" x 10" Master Model 12 table which is positioned in 2 axes to an accuracy of .001". The controls for the table are compactly packaged in a 16¾" x 15⅝" x 10½" console weighing under 60 lbs. The entire unit, table and all, fits easily on an ordinary work bench.



The table is controlled by means of a Binotrol punched tape system. This is the system Barnes Engineering Company, Stamford, Conn., originally developed to control the Jones & Lamson No. 7 turret lathe, making its operation completely automatic. In this system, all operating instructions are punched on a tape, and the Binotrol system "reads" the tape, and controls the motion of the table.

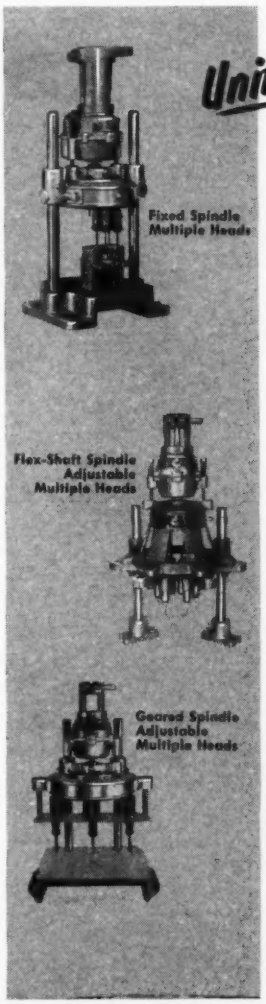
The new table can be used in combination with a drilling machine, miller or any other common machine tool to ream, sink, tap, mill, screw or perform any of the usual machine shop operations. The entire sequence of operations is permanently preserved on the tape, which can be filed away and reused at any time.

Preparing a tape is a relatively simple task that demands only a knowledge of the most efficient sequence of operations for the machine. The tape, unlike a human operator, feeds the same signal to the machine each time; hence the human factors of fatigue, carelessness, etc. are eliminated and the machine will always perform within its specified accuracy.



In operation, the positions of the two lead screws are continually being compared with the required positions as indicated by the punched tape. When there is a difference in position, a voltage is applied to two motors, one for the X and one for the Y position, which drive the lead screws to the required, or zero difference, position.

For Information Concerning Available Reprints and Books Please Refer to the Huebner Publications Listing in the Advertisers' Index.


Fixed Spindle Multiple Heads
Flex-Shaft Spindle Adjustable Multiple Heads
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Unit engineered for greater small hole drilling and tapping production!

ETTCO-EMRICK MULTIPLE HEADS

BOTH the head and workholder are designed as a *unit* to your requirements to give you a *complete* high production system capable of maintaining highest production rates on your drill press. Thus, you are not only assured of drilling and tapping the maximum number of holes at each stroke but — what is just as important — the fastest handling of the parts.

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Ettco-Emrick
the right equipment for every small hole drilling and tapping need.

CIRCLE INFORM-A-GRAM KEY NO. 147

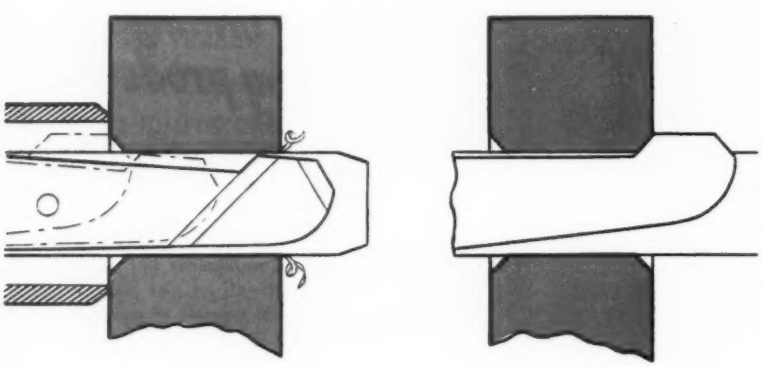
Stanley R. Cope Receives Annual Presteel Award

The metal stamping industry's 1956 Presteel Award was presented to Stanley R. Cope, president of the Acme School of Die Design Engineering in South Bend, Ind., at the Pressed Metal Institute's Annual Meeting last month.

Mr. Cope's selection was based on his training of some 2,500 die design students and for his research projects which have resulted in improving various stamping procedures, according to the award committee.

The award was established in 1954 by the Worcester Pressed Steel Co., in conjunction with the PMI, to honor an individual, company or association for outstanding contributions to the metal stamping industry.

At the same PMI meeting, Bruce Krasberg, president of R. Krasberg & Sons Mfg. Co. of Chicago, was elected president of the PMI. Clint Stryker, president of Maysteel Products, Inc. of Milwaukee, is the newly-elected first vice president; and Carter C. Higgins, president and general manager of the Worcester Pressed Steel Co. of Worcester, Mass., is second vice president.



The Cogsdill BurraMatic

chamfers from inside-out!

The Cogsdill BurraMatic size controlled chamfering tool has been especially designed to deburr and chamfer holes on any metal part using a forward feed stroke only.

Among its exclusive precision chamfering features, important for high production applications requiring different depths of chamfer on top and bottom, the BurraMatic tool offers separately adjustable cams for depth control on both sides.

Overtravel feature compensates for error in part positioning.
Cam action collars for adjustments to upper and lower chamfer.
Low-cost cutting blade replaceable by removal of pin.

Cogsdill TOOL PRODUCTS, INCORPORATED

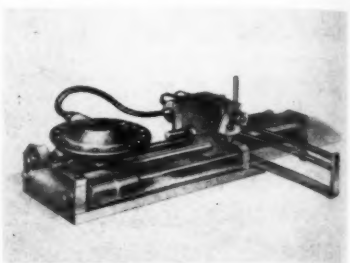
12980 West Eight Mile Road, Oak Park 37, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 148

New Air Feed Series Introduced

An unusual mobile air feed series has been added to the Ses-Matic press room equipment line by Special Engineering Service, Inc. The feeds can be moved easily from press to press without time-consuming effort.

These units are designed for direct mounting to the bolster plate of the press. The only other tie-in necessary with the press is the mounting of a valve so that it will be tripped by some moving part of the press ram or die.



The Ses-Matic air feeds are available for maximum stock widths of 8", 12" and 18" and maximum feed stroke lengths of 8", 12" and 18". They are adjustable for both width and stroke length from their maximum to 0. The thickness of the stock that they will handle depends upon the stock width—5/32" thick up to 8" wide, 0.125" up to 12" and 0.093" up to 18".

The coiled stock being fed is guided at both the front and rear of the Ses-Matic air feed. On a signal from the press, a diaphragm gripper assembly connected to the end of the feed cylinder, grips the stock and pulls it forward to the end of the feed stroke, where it is released. The stock is always fed on the up-stroke of the press.

Literature and complete specifications on this series of Ses-Matic air-operated press feeds can be obtained from Special Engineering Service, Inc., 8161 Livernois Ave., Detroit 4, or—

Circle Inform-A-Gram No. D3.

Have You Read About the Newest Magazine in the Metalworking Field?

Write Metlfax 1975 Lee Road, Cleveland 18, Ohio for Complete Details.

carbide NEWS

The Wesson Study Tells You:

1. To what extent your own industry is already using single point tools with throw-away tips.
2. What the future plans of your industry are with regard to use of throw-away tooling and why.
3. To what extent your industry is considering the use of throw-away blades for milling, boring, etc.
4. To what extent plants of your size can use throw-away tooling effectively.

WESSON can also help you select the right kind of throw-away holders and tips to give you maximum performance and economy, cut machine down time, reduce inventory and improve product quality.

Ask us to prove it.

WESSON makes national survey data available

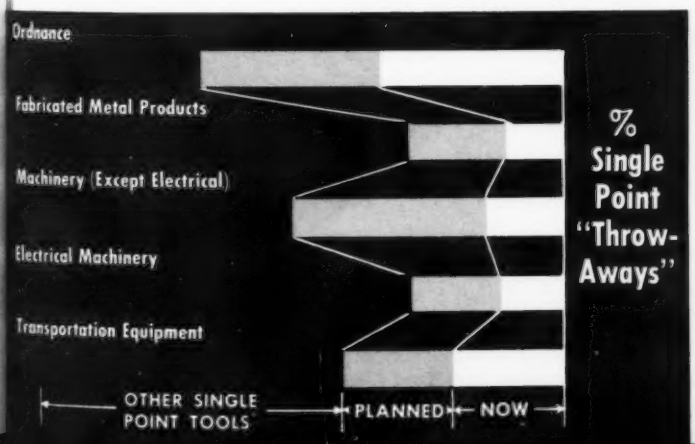
Industry Reports Big Jump in Use of Throw-Aways

HOTTEST NEWS in the carbide tool field right now is the astounding growth in popularity of "throw-away" tooling as revealed by the survey of metalworking industries by Wesson Company.

Conducted through an independent technical market research organization, the study shows:

1. Industry is seriously considering assigning a majority of all single point tool operations to "throw-aways". Some plants are thinking in terms of "as near 100% as possible".

(continued on next page)



THE BIG THREE IN THE THROW-AWAY FIELD---

#1 INDUSTRY SAYS IT WANTS the features which WESSON has incorporated in all of its holders for single point tooling with indexable disposable tips, including STANDARD REPLACEABLE PARTS, ADJUSTABLE CLAMP WITH CARBIDE FACED CHIP BREAKER, ONE PIECE ANVIL LOCATOR, etc., etc. If you are not familiar with these holders, be sure to ask us for complete data covering holders for your types of operations. Our Bulletin 55-11-M will help you to do this quickly.

Industry Reports Big Jump in Use of Throw-Aways

(continued from page 1)

2. "Throw-aways" already represent over 15% of all single point tooling in metalworking plants. In those plants already using "throw-aways," the percentage is 25% of all single point operations.
3. Industry is receptive to the idea of using milling cutters that require no grinding on an even broader basis.
4. Industry is also seriously considering the use of no-grind (throw-away tipped) tooling for other multiple point tooling such as boring tools, etc. on a broad basis.
5. Primary reasons for industry's interest in tooling up with tips that are thrown away when dull are:
   a. Elimination of all tool grinding.
   b. Important reduction in machine down time for tool changes.

   Other factors include lower tool cost, reduced inventories, etc.

Included in the Wesson study are analyses of trends in the use of single and multiple point tools with throw-away tips by industry and by plant size (based on annual tool consumption). Results of the survey are available on request to all USERS of carbide tools.

Wesson tools carbide Wessonmetal

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1220 Woodward Heights Blvd., Detroit 20, Mich.

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WESSON CUTTING TOOLS, LTD.
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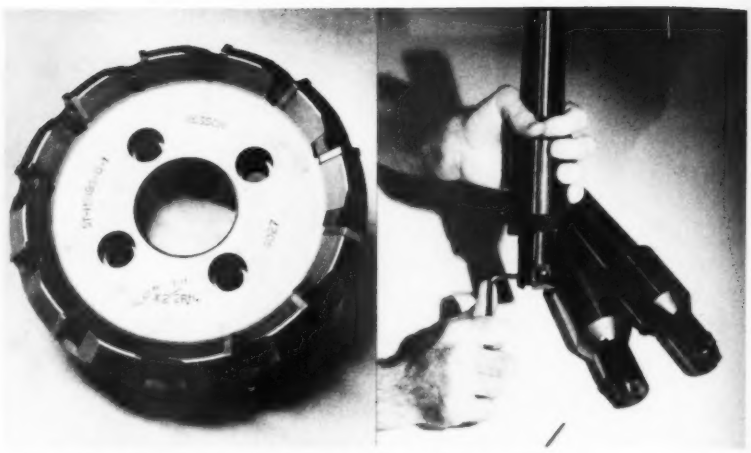


THE BIG THREE IN THE THROW-AWAY FIELD - - -

#2 ***THE WESSON "NO-GRIND" Milling cutter, introduced at the Tool Show in Chicago promises to launch a new era in milling in the metal-working industries, according to reports by the industry itself. Using disposable carbide tips with eight cutting edges each, it eliminates all cutter grinding, reduces milling cutter inventory, cuts overall costs per piece.***

#3 ***THIS MICRO-ADJUSTABLE BORING TOOL with no-grind disposable inserts is one of a series developed by Wesson. It has all the features, apparently, that industry is looking for.***

"No-Grind" Chamfering Tools Added to Wesson Standards

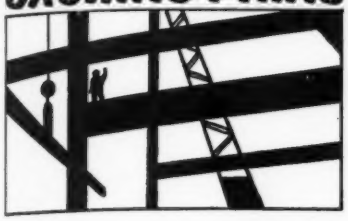
Two new holder styles designed for 30-degree and 45-degree chamfering operations have been added to Wesson's line of standard Multicut holders for throw-away carbide inserts.

The holders offer wide versatility, being applicable also to straight turning, plunge feed turning and facing operations. The 30-degree lead angle style designated TDRC-TDLC is also suitable for 90-degree shoulder turning by angling the holder in the tool block. The 45-degree lead angle holder style is designated SERC-SELC.

Both holders incorporate low cost, standard replaceable parts including a one-piece insert seat and locator, adjustable carbide faced chip breaker-clamp, and locking screw. The TDRC-TDLC employs standard triangular "No-grind" inserts while the SERC-SELC are designed for use of standard square inserts which provide a total of eight cutting edges before discarding.

The large clearances provided in the design of these holders make them especially suited for "gang" setups. Sizes available are shown on Bulletins 896-1A (SERC-SELC) and 896-2A (TDRC-TDLC).

GROWING PAINS



With construction of **Automatic Electric Company's** new headquarters plant in Northlake, Ill., progressing rapidly, it has been disclosed that the size of the manufacturing and research center has been increased by approximately 200,000 sq ft. The increase brings overall floor area to over 1,500,000 sq ft. More than 7,200 persons now working in 16 separate buildings in the company's Chicago plant will be employed in the new building. The new factory will be completed in the summer of 1957.

◆

Toolset, Incorporated has moved to new and larger quarters on Military Rd. in Buffalo, N. Y. Removal of general offices, engineering, assembly and warehousing to the new location is releasing space for expansion of present machine shop facilities. The company produces a complete line of self-contained, self-stripping units for piercing and notching ferrous, non-ferrous and non-metallic materials.

◆

The completion of a quarter-million-dollar plant expansion program has been announced by **Zero Manufacturing Company.** It increases the firm's production area to 85,000 sq ft. Zero's principal products include precision deep-drawn aluminum cases, boxes, instrument cases and combination carrying cases for the electronics and aircraft industry.

◆

An extensive expansion program is now underway at **Hewitt & Faust Manufacturing Company.** An addition to the main plant which added approximately 8,000 sq ft and permitted installation of new equipment and replanning of floor space, was completed recently. Ground has been broken for the construction of a new building adjacent to the main plant. The company is a supplier of specialized tooling, jig and precision sheet metal components.

◆

A new plant that will double present manufacturing capacity is being erected by **New York Twist Drill Company, Inc.** adjacent to its present building in Westbury, L. I. The additional facilities will provide sufficient space for expansion for another five year period. The firm manufactures a wide range of industrial twist drills. The new factory addition will permit extending size ranges to include 1⅛".

Lear, Incorporated has announced the opening of a new research and development building adjoining its other facilities at Santa Monica Municipal Airport. The new structure houses the West Coast engineering branch of the company's Grand Rapids (Mich.) division.

◆

Doubling of production and engineering facilities at the Rahway, N. J. plant of **Circo Equipment Company** has been completed. A rapid increase in the sale of degreasers, metal parts washers and ultrasonic equipment made the expansion necessary.

A two-million-dollar central service building is being built at the Worcester, Mass. plant of **Norton Company.** The factory and office structure will centralize the plant's engineering department and a variety of crafts which service the entire plant. About 500 people will work in the new building.

◆

American Drill Bushing Company has finished an addition to its factory in Los Angeles. The new building will house private, general and executive offices, and factory which will double the output of drill jig bushing production.

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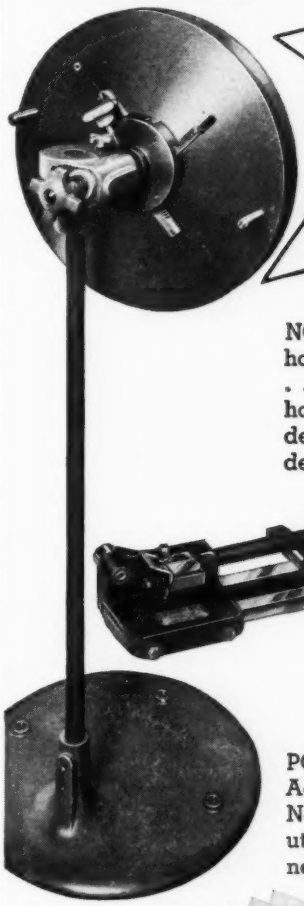
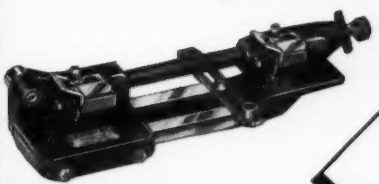


NOW, one versatile stock reel is capable of handling a wide range of standard coil sizes . . . 16", 20" and 24" and is available to handle coils up to 36" diameter. Specifically designed and "shop tested" for use with the dependable Dickerman Hitch Feed,® this new reel will easily handle all coils conventionally used with a hitch feed!



You'll be days and dollars ahead with this precision-production Hitch Feed, Stock Reel team.

PORTABLE from one press to another . . . Accommodates coils from ¼" to 2½" widths. New coils of stock may be loaded in minutes! The reel is equipped with frictionless needle bearings, is self centering, and has a brake to control de- reeling speed.

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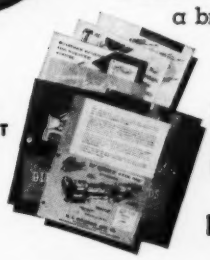

Dickerman

H. E. DICKERMAN MFG. CO.

321-215 Albany Street, Springfield, Mass.

CIRCLE INFORM-A-GRAM KEY NO. 151

CAST BERYLLIUM-COPPER FORGING DIES

by Clyde L. Frear
Industrial Engineering Unit
BUREAU OF SHIPS

THE NAVY USES large numbers of forged parts in the construction, maintenance, and repair of naval vessels. Many of the parts are made in steel dies in order to hold the shape and size within close tolerances. As a result, numerous dies are stored at the various naval shipyards and at other activities for use in forging similar parts needed at some future date.

There are many cases, however, where a few of the forged parts are urgently needed by a particular activity but no suitable die exists; or the die is located at some distant activity. It is highly probable that many of the steel dies have been used for only a single lot of forgings and have been occupying valuable storage space since the time of their original use.

To store steel dies, strong steel racks and suitable mechanical equipment for handling to and from the storage space are needed. Preservation of the steel dies is an added expense.

Manufacture of a steel die is a very costly process involving all-over finishing of a forged steel die block and slow profiling of the die cavity, often followed by heat-treating to provide the necessary hardness and impact resistance.

Late Development

One of the latest developments in the manufacture of forging dies is the use of cast beryllium copper. This metal has a number of economic and other advantages over the use of steel dies. Chief among the advantages are:

1. Beryllium copper is easily cast by the use of ordinary nonferrous foundry equipment.
2. The die can be cast to shape, and it requires only the removal of the rear portion of the cast block, milling of the contact surfaces, and polishing of the die cavity. No profiling is necessary.
3. In the case of intricate dies, the delivery time for cast dies would be considerably less than that of profiled dies.
4. A die can be easily and economically recast if design changes are necessary.
5. Beryllium copper has high self-lubricating qualities. Its use reduces considerably the amount of die lubricants needed during forging.
6. The amount of die storage space needed is much less. Recasting a new die is usually cheaper than storing the old one when there is any doubt about the need for future use. Storing a pattern is much more economical than storing a die if use at some future date is expected.

To meet the problem of making prototype and other short-run forgings quickly, North American Aviation, Inc., inaugurated a research program to investigate materials for forging dies that would simplify die-making and still give a die life long enough to permit forging from 100 to several thousand pieces.

The Wyman-Gordon Company has used cast beryllium-copper dies for

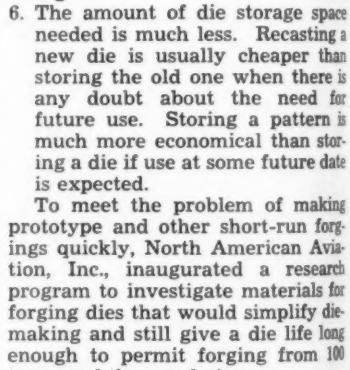

Fig. 1. A plaster pattern (left) and a beryllium-copper die (right).

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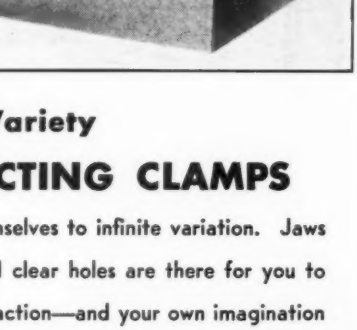
Lodding Retracting Clamps lend themselves to infinite variation. Jaws are added to suit work. Tapped and clear holes are there for you to use. Lodding provides four types of action—and your own imagination is the limit to the variety of jaws you can add. Four sizes each of four styles—hand knob, hand cam, nut and air operated.



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CIRCLE INFORM-A-GRAM KEY NO. 152

several months, and has found them successful for aluminum and magnesium forgings. Another company has produced at least 400 stainless steel parts without having the die become unusable. Wright-Patterson Air Force Base is continuing this development work to determine the practicability of beryllium-copper dies for large aluminum and magnesium forgings made in 35,000 and 50,000-ton presses.

Generally, the pattern equipment should be very simple as compared with equipment for castings. The shape of a forging is necessarily much less intricate than the shape of nearly any casting. In most cases, the pattern would be made of soft wood, in the shape of the die block, with the die cavity in one face.

The pattern would be built with a double shrink. The total shrinkage would be that of the beryllium copper itself, plus the shrinkage allowance for the forging. In many cases a suitable pattern could be made from plaster of paris in a very short time and at small cost.

Normally, only one mold would be made from the pattern; therefore, no greater outlay should be invested in the pattern than would be absolutely necessary. In specified cases, a double shrink model of the required part could be made of wood or plaster, and the necessary pattern made by casting in plaster. Figure 1 shows such a plaster pattern.

Plastic Pattern

If the same part is expected to be forged in the future, and if a new die would be required, a better pattern should be made. A plastic pattern, for example, would retain its shape and dimensions indefinitely in the salt air of a naval shipyard, yet would be very easy to store.

Molding practice for beryllium copper is similar to that for bronze. Standard sands used for nonferrous materials will prove satisfactory. Moisture content should be maintained as low as possible in accordance with sound foundry practice. Where fine detail is needed, very fine sand will help, not only in reproducing detail, but also in lessening final machining and polishing.

Normal sand cast shrinkage of beryllium copper is 3/16"/ft. Gating should permit the metal to enter the mold at the bottom, and should provide adequate feeding with minimum agitation.

Choke gates and strainer cores can be used to advantage for reducing turbulence. Figure 2 is a photograph of the drag portion of a mold for the die shown in Figure 1. A swirl gate of the type shown in Figure 3 probably would aid in cleaning the metal and preventing turbulence.

Risers should be relatively large, and placed so that the last — and therefore the hottest — metal to enter the mold will be in the risers. Open risers not only serve as vents and aid in removing steam and gas, but also give the added advantage of atmospheric pressure. An exothermic material over the riser helps maintain temperature for large castings, insuring proper feeding of the casting. Standard core-making practices have proved satisfactory in foundries handling beryllium copper.

Fig. 2. Drag portion of mold for beryllium-copper die.

Melting

Beryllium copper alloys melt quickly in either electric, gas, oil, or coke-fired furnaces. Electric furn-

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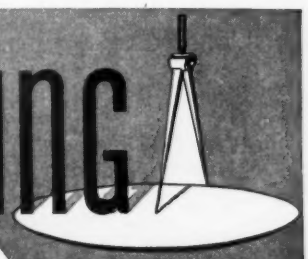

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CIRCLE INFORM-A-GRAM KEY NO. 153

aces of the arc or induction types provide rapid heating and good temperature and quality control.

In using coke, gas or oil-fired furnaces, care should be taken to prevent the pick-up of combustion products. The slow melting rates of the products as compared with the melting rates with electric furnaces, mean longer exposure to contaminants.

For best results, each heat should be of known quality and composition. Generally, virgin metal is used together with clean foundry scrap, such as gates and risers. To obtain the desired properties, impurities should be restricted to a minimum. This restriction can best be made by seeing that beryllium copper scrap used in melting is not contaminated by other materials, and that crucibles are clean.

Some loss in beryllium can be expected in remelting scrap. Oxidation losses should not exceed 10%. Scrap such as gates and risers can be remelted approximately three times without appreciably reducing hardness through loss of beryllium. Stirring should be avoided whenever possible, since this tends to increase beryllium loss.

Fluxes or slag covers are not needed, but hot dry charcoal covers are recommended when a rocking arc furnace is used. Since beryllium itself is a deoxidizer, deoxidants are not required. The proper control of melting and pouring temperatures is important. In general, the metal should not be heated hotter than is necessary for pouring at the desired temperature.

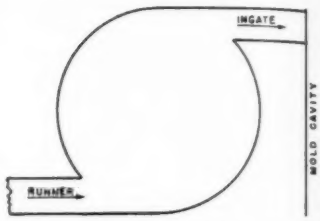

Fig. 3. Suggested swirl gate.

When the proper pouring temperature has been reached, the charge should be poured immediately and not held in the furnace. The metal should be poured through as short a distance as possible with minimum turbulence. During melting, beryllium copper tends to form less dross than the usual nonferrous alloys.

Any problem with dross formation is best remedied by close control during melting. Dross may result from excessive agitation of the molten metal in the mold, or by sands of high moisture content.

Beryllium copper is capable of solution hardening by proper heat-treatment and aging. As soon as the gates and risers are removed, the cast die should be heated to 1,450°F for one hour for each inch of casting thickness, and quenched in water.

This treatment should be followed by reheating to 800°F for two hours after the casting has become heated throughout to this temperature. After the treatment the die should be

Fig. 4. Cast copper beryllium die showing gates and risers.

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has the "CALIBER" and "ACCURACY"
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water quenched or cooled in air.

The treatment results in a C-35 Rockwell hardness, which gives the best combination of hardness and impact resistance. A hardness of C-40 Rockwell can be obtained by heating the quenched casting to 600°F. At this higher hardness, however, the shock resistance is low for impact forging dies. There has been no difficulty in machining and polishing a suitably heat-treated die.

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Lock Parts Tumble Out in Smooth Broaching Setup

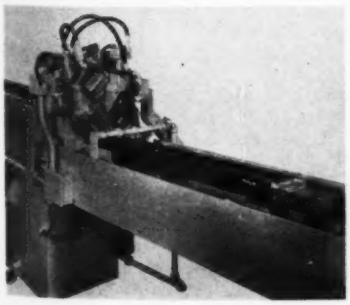
An ingenious arrangement using an eight position indexing fixture, manual loading and automatic unloading enables a lock manufacturer to turn out brass lock cylinders at the rate of 1250/hr.

Work is done on a model HS, 10 ton, 60" stroke universal horizontal broaching machine built by Colonial Broach and Machine Company, P. O. Box 37, Harper Station, Detroit 13, Michigan.

In addition to the high production rate possible on this installation, considerable flexibility in part size is also possible. Cylinders varying in length from 5/8" to 2" and either 0.402" or 0.451" dia are all handled by this fixture with only minor changes in the tooling.

Operation is continuous with five lock cylinders being broached at a time. The rotary fixture has four broaching stations and four broach

Fig. 1. Broaching setup designed and built by Colonial Broach turns out 1250 lock cylinders/hr. Five parts are broached per machine stroke. Fixture is shown in the broach return position.



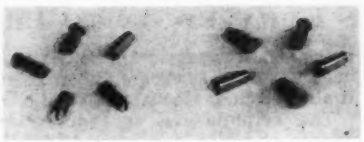


Fig. 2. Lock cylinder blanks are shown at right, finished machined parts at left.

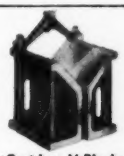
return positions. The fixture indexes 45° at a time, every other index bringing a new group of lock cylinders into broaching position. Parts are loaded manually but are clamped and ejected automatically. Broaching speed is 30 ft/min and return speed is 100 ft/min.

Alignment tolerance on the part is held within 0.001" variation, an important consideration in assuring trouble free operation of the assembled locks. Since the machine is controlled by push buttons and limit switches, the operator has complete control over the operation at all times. An over-riding clutch with automatic interlocks provides fast indexing and prevents movement of the ram while the fixture is being indexed.

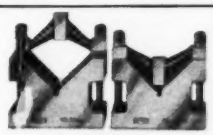
For Fast Accurate Setups

These Taft-Peirce Specialties are a 'must' for machining and inspection in the toolroom

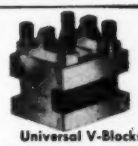
V-BLOCKS



Cast Iron V-Blocks
Accurately ground to size in pairs. Made from finest quality seasoned grey iron castings. All surfaces except top are square or parallel with each other within .0005".

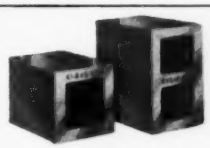


Steel V-Blocks
Sold in pairs only. Made of alloy steel, hardened and ground. "V" is central with sides, parallel with bottom, square with ends within .0003". All surfaces square or parallel within .0002".

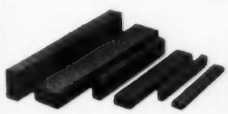


Universal V-Blocks
Hole in center permits quick, accurate setups. Also provides clearance for tool in drilling and boring. Made of alloy steel, hardened and ground on all working surfaces. All sides square within .0001". Sold singly or in pairs.

PARALLELS



Box Parallels
Made of finest quality close grained cast iron. All sizes are parallel within .00025" in 6 inches, square within .0005" in 6 inches. Will pair up within these limits.



Steel Parallels
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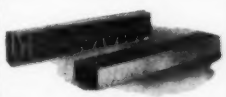

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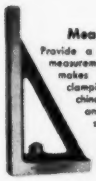
Duplex Angle Irons
Finished inner pads increase accuracy, speed setup work and usually eliminate need for table clamping. Inner pads parallel to sides within .0005". Outer faces square within .0005" in 6".



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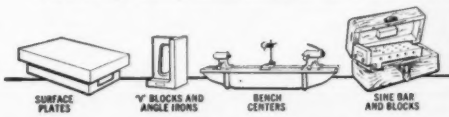

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THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, RHODE ISLAND

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Oxide Coatings Sprayed on to Protect Surfaces

Ceramic rods, atomized and applied under high temperature, are proving remarkably successful in protecting underlying metals from abrasion and excessive heat in rockets, jet engines and guided missiles as well as a number of commercial applications.

Rokide coatings, developed by Norton Company, Worcester, Mass., and applied with a specially designed gun made by Metallizing Company of America, protects a wide variety of base metals against the effects of heat, abrasion, erosion and corrosion. It also provides electrical insulation.

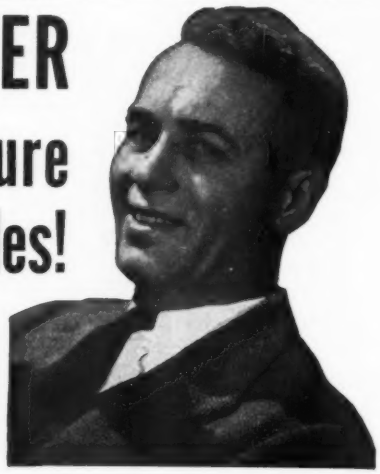
The ceramic rod is reduced to molten particles in excess of 5,000°F in the oxy-acetylene gun. These particles are projected at high velocity by the compressed-air-powered gun onto the metal surface to be coated. The metal surface is previously roughened by grit blasting and the resultant bond shows good adherence. Thickness of the coating is

usually about 0.005", although coatings of 0.00001" have been successfully applied.

At the present time three Rokide coatings are available in ⅛" and 3/16" dia sizes. Rokide A is an aluminum oxide coating; Rokide ZS, a zircon rod which dissociates into zirconium oxide and silica in the oxy-acetylene flame; and Rokide Z, a time stabilized zirconia rod.

Both the coatings and the method of application are protected by Norton Company patents. Norton Company will license any firm to use the coating on a non-exclusive basis.

"HOVIS WASHER DIES have sure solved our troubles!



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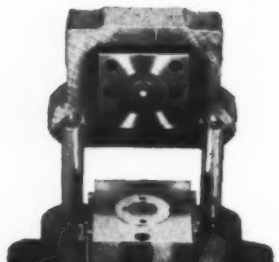

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CIRCLE INFORM-A-GRAM KEY NO. 156

Performance of New Gear Grinder Demonstrated

Precision performance of a new gear grinder, developed by The Sheffield Corporation, to help achieve higher volume output of extremely accurate gears for powering modern weapons, aircraft, and ordnance controls, was demonstrated recently in a two-day series of evaluation tests conducted in Dayton. In attendance were nearly 100 officials of some of the nation's leading producers of equipment, for the armed forces, military, government engineering, and production specialists.

The demonstration put the company's new Model 140 reciprocating gear grinder through an exhaustive series of tests.

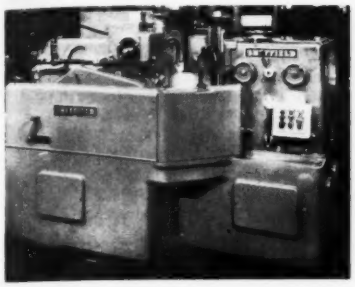
This grinding machine is designed for grinding external precision spur and both right and left hand helical gears from 8 to 100 pitch.

Gears ground on the machine are used in precision instruments, gear train timing devices, fire control mechanisms, aircraft accessory power units, machine tools, engines, transmissions, and where quiet gear operation is necessary. A number of gears of the same type can be

ground simultaneously from hardened steel in preformed or solid blanks or, gears can be ground individually.

The grinding wheel (12" x 5" x ½" to 2") is formed to the basic rack form by the Sheffield automatic Crushtrue wheel dressing process. The gear blank or blanks are mounted in grinding position between head and tailstock centers.

The grinding operation is similar to hobbing in that the work rotates continuously at a rate of speed synchronized with that of the grinding wheel. Simultaneously the work moves upward past the horizontal center of the wheel until the tooth



form is imparted to the full face of the gear blank. In addition to this basic hobbing motion the work rolls across the full face of the helical rack form of the grinding wheel.

The Standard model 140 gear grinder will accommodate a maximum work diameter of 8" OD x 5" face width. Maximum length between centers is 15". Change gears permit the number of teeth that can be ground to range from 4 to 192.

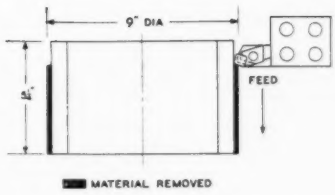
Maximum helix angle adjustment of wheelhead is 45° right and left hand. The grinding wheel is mounted on a precision pre-loaded ball bearing spindle. Grinding wheel spindle speed is 2100 rpm; crushing speed, 116 rpm.

The machine occupies a floor space 103" x 132" and is 71" high. All electrical and hydraulic units are to J.I.C. standards.

General Purpose Carbide Inserts Beat Specials

Tough machining jobs don't always call for special carbide grades. Frequently a general purpose grade will do even better. Typical is the job shown here — turning the OD of a coupling — at J. W. Bullard & Sons, Inc., Fairfield, Connecticut. Looks simple, but the steel (low-carbon chrome-moly-vanadium) is unusually tough and scaly and the forgings have a decided warpage.

With all that scale, and with depth



of cut due to warpage varying as much as from .070" to .180"/pc, tool breakage dropped tool life to only around 24 pcs/tool (4 pcs/grind) even though using specialized steel cutting grades.

The job was re-tooled with a Wesson Multicut tool holder using throw-away blanks of Wessonmetal 26 — a wide range general purpose steel cutting grade. Tool performance jumped to 100 pcs/cutting edge (800/insert) with no grinding required.

In addition, output was doubled since the performance of the thin Wessonmetal 26 throw-away blanks permitted a stepping up in both feed and speed on the Gisholt lathe.

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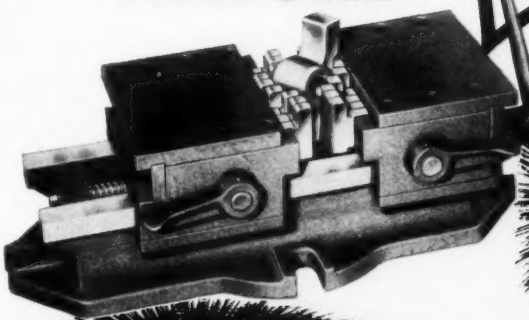

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CIRCLE INFORM-A-GRAM KEY NO. 157

AUTOMATIC LOADER FOR INTERNAL GEAR SHAVING MACHINE

A unique new Red Ring fully automatic loading device for handling spur or helical internal gears on shaving machines has recently been developed.

The loader, built by National Broach & Machine Co., 5600 St. Jean Ave., Detroit 13, solves a difficult automatic loader design problem: that of meshing the teeth in an internal gear with those of the helical gear-shaped shaving cutter. An intermediate air-powered loading sleeve mechanism which receives the internal gears one-at-a-time from a magazine feed, hangs them on the cutter and provides the meshing problem solution. The loader can be installed on the Company's Model GCR internal shaving machines, Figure 1.

Internal gears to be shaved are loaded in a magazine where they roll by gravity to a position in front of an air-powered plunger. The plunger pushes one gear at a time into the loading sleeve, which is mounted on a swinging arm and swung through an arc by an air cylinder-controlled linkage. The pushing of an unshaved gear into the sleeve at this raised position causes a finish-shaved gear in the other end to be deposited in an unloading magazine where the shaved gears roll to a location at the front of the machine.

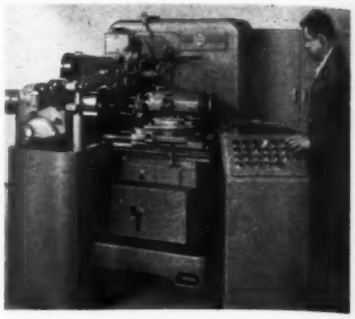
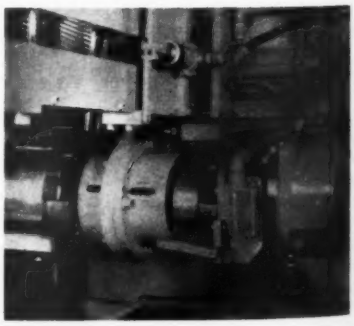


Fig. 1. The new Red Ring fully automatic loader for internal gears installed on a Model GCR internal gear tooth shaving machine. The loader handles a 75-tooth, 20-pitch, 4" pitch dia, 20° pressure angle, 18½° helix angle internal gear at a rate of 70 gears/hr.

In the next loader sequence, the sleeve holding the unshaved gear is swung downward by the air cylinder into line with the work spindle centerline. A finish-shaved gear in the chuck on the work head is ejected by another air cylinder into the sleeve. Entry of the finish shaved gear ejects the unshaved gear in the other end

Fig. 2. A close-up view of the equipment shown in Fig. 1. Here the loading sleeve is in its lower position in line with the workhead centerline. A finish shaved gear has just been deposited in the left hand end of the sleeve. A gear to be shaved has been ejected from the sleeve at the right hand side and is hanging on the shaving cutter. In the next sequence, the sleeve will swing upward out of the way and the cutter spindle will advance to the left where the gear will be chucked in the workhead.



Buck AJUST-TRU CHUCKS

"Hold O.D. and I.D. within .001" day in and day out."

Buck Ajust-Tru chucks are ideal for precision grinding. Most recent report is from Mr. Chester Nelson, Supt. Press & Machine Div., J. I. Case Company, Bettendorf, Iowa. He writes —

"The part has been O.D. ground on a Centerless Grinder first, then the I.D. is ground by being held in the six (6) jaw Buck Chuck. The accuracy of the Buck Chuck is used to its fullest extent since the O.D. and I.D. have to be concentric within .001" total indicator runout. This tolerance is being held constantly day in and day out."

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CIRCLE INFORM-A-GRAM KEY NO. 158

of the sleeve into mesh with the shaving cutter, Figure 2, where it remains hanging on the cutter.

Then the loading sleeve is raised back to the load position. The internal gear and shaving cutter are then advanced as a unit toward the chuck in the workhead and the gear is chucked, ready for the shaving operation, with the cutter in mesh with the gear. At the end of the shaving operation, the cutter spindle is backed out of the gear and returned to its original position for the loading of another unshaved gear.

—•—

Grip Rings in Tape Recorder Eliminate Rejects

A unique fastening system which eliminates a number of costly machining operations and sharply reduces rejects has been developed by the Mark Simpson Manufacturing Co., Long Island City, N. Y., producer of electronic equipment, in conjunction with Waldes Kohinoor, Inc., manufacturer of retaining rings and other products, also in Long Island City.

The system is incorporated in Simpson's "Masco 500" portable tape recorder and has proven an effective means of slashing manufacturing and maintenance costs.

The recorder utilizes a zinc die-cast base with molded studs to which component parts and sub-assemblies are secured. The parts are fastened to the studs by means of Waldes Truarc series 5555 grip rings.

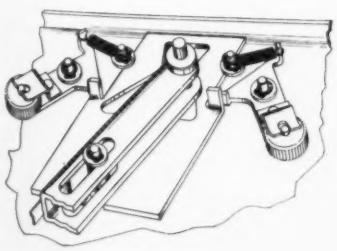
According to Simpson engineers, the stud-grip ring arrangement makes possible a number of savings:

1. The rings replace nuts, screws, cotter pins and other fastening devices which require threading, tapping, drilling and other expensive machining operations.
2. Because the rings require no grooves — they exert a frictional hold against axial displacement — they may be seated at any point on the studs. As a result, the fasteners compensate automatically for any accumulated tolerances in the parts being secured.
3. Because no machining operations are necessary to prepare the studs for fastening, the danger of cracked or broken studs is virtually eliminated. Since a single stud failure would render the entire cast base useless — and with it all assembly completed to that point — the system also eliminates extremely costly rejects.

Typical applications of the fastening system may be found in the recorder's pivot and brake assemblies shown in the illustration.

Pivot assembly of the shift lever (center) is secured by a single Truarc grip ring and washer. Because the washer must be installed over the lever in a sliding fit, critical tolerances would have to be maintained if a screw or cotter pin were used. The grip ring eliminates that problem: it requires no groove and may be seated over the washer at any point on the stud, compensating automatically for any accumulated tolerances in the parts.

Brake assemblies (upper left and right) use grip rings to secure brake wheel and spring sub-assemblies. Here again problems of critical tolerances are avoided and expensive rejects eliminated.



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Electromagnetic Clutches Replace Reversing Motor

Now an operator can slide a workpiece into a fixture on a tapping machine, press the start button, then watch the machine tap four holes to different depths, reverse and back out the taps. This, in itself, would not be so unusual, except for the fact that the unit is driven by a motor which runs continuously in one direction!

This is the result of co-operation between Ettco Tool Co., Brooklyn, manufacturers of the lead screw tapping unit, and Warner Electric Brake & Clutch Co. of Beloit, Wis., pioneers in the development of electric motion control.

In Figure 1 is shown the fixture used to tap four 10-24 holes of different depths in a workpiece. The Ettco-Emrick automatic lead screw unit is a self-contained, electrically controlled and actuated device which has been developed for fast single or multiple spindle tapping or threading. Use of Warner fractional horsepower forward and reverse clutches eliminates the need for a reversing motor and greatly increases the speed of the tapping operation. A valuable feature of this drive system is the fact that torque output of the clutches can be varied by a rheostat control. This provides the sensitivity needed for small taps, as well as the power required to drive large taps.

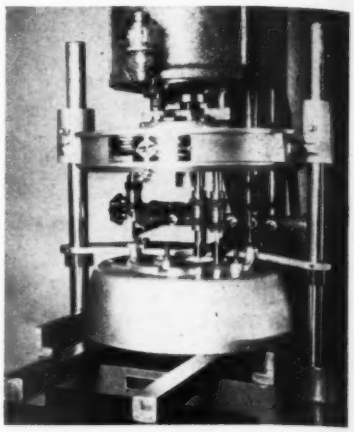

Fig. 1. This Ettco-Emrick lead screw tapping unit taps four 10-24 holes to different depths with a continuously running, unidirectional motor. This is accomplished with two Warner fractional horsepower electric clutches, one for feeding and one for reversing.

Because the actuating force (electric current) is the same as the motive force (magnetic flux), engagement and release of the clutches are instantaneous. In fact, they can be controlled to operate within milliseconds. This type of driving force eliminates any end pressure on the lead screw or taps. As a result, threads cut are as accurate as the taps or dies used.

Operation of the clutches follows: the armature of the downfeed clutch is keyed to the continuously running drive shaft of the motor, the rotor is mounted on the lead screw, and the stationary field is mounted on an internal bracket. On the reversing clutch, the armature is bearing mounted on a sheave driven by a v-belt from a reversing idler pulley, the rotor is keyed to the lead screw, and the stationary field is mounted on a bracket.

When the operator presses the start button, the downfeed clutch is energized and current flows in the stationary field. Magnetic flux passes through the rotor (keyed to the lead screw) and locks it to the armature (keyed to the motor drive shaft) in full magnetic couple, thus

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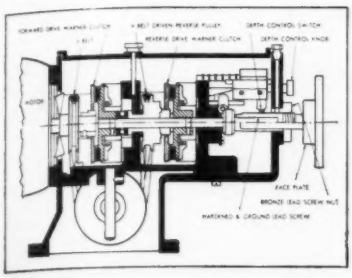


Fig. 2. Cross-sectional view of the lead screw tapping unit shows the arrangement of the forward and reverse electric clutches, as well as the depth control system.

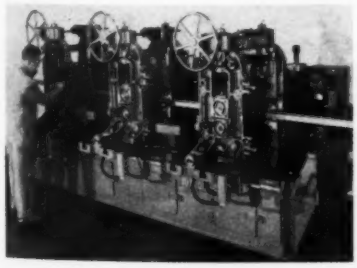
driving the lead screw and tap through the work. When it reaches the depth for which it is set, a nut actuates a snap-acting switch, the downfeed clutch is de-energized, the reverse clutch is energized (and functions like the downfeed clutch), and the lead screw and tap reversed and run out of the work. Another snap-acting switch is actuated at the top of the travel of the lead screw and the reverse clutch is de-energized and the cycle ended.

The unit is flexible in operation because the torque output of the clutches can be changed even during the cycle. Also, the torque of the downfeed clutch can be set at a point where the clutch will stall if a tap sticks or hangs up.

A New Concept in Correcting Extrusion Contours

A new contour correcting and straightening machine has been developed, in response to demands by the aluminum extrusion industry for an effective means of correcting cross-sectional distortions of aluminum extrusions.

Creation of the machine by the Sutton Engineering Company, Pittsburgh 22, Pa., was based on an entirely new concept of the contour correcting problem with experimental work and development engineering having been carried out over the past three years.

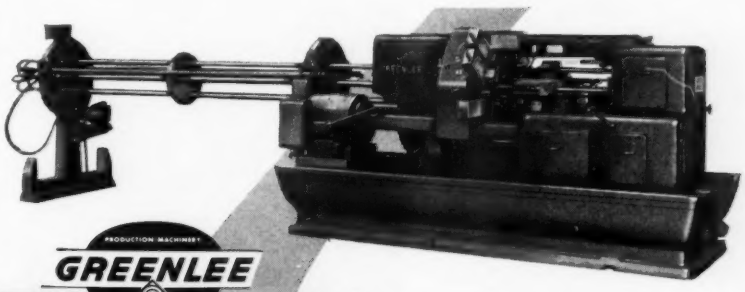


Designed for simple change-over to different extruded shapes, the machine employs multiple rolls of simple design, providing complete flexibility to correct cross-sectional distortions that occur in the extrusion and heat treatment of today's complex shapes.

The machine is furnished with one or more contour correcting stands, with provision for additional stands to be added, if desired. For simple shapes, a single stand can be used. For more complex shapes, two or more stands are desirable to accomplish multiple corrections in one pass.

The first of the new contour correcting and straightening machines to be built are installed in three Mid-Western aluminum plants and additional machines are on order for other extruders.

It is expected that this machine, on which patents are pending, will help fill a current need for economically processing high quality extrusions to extremely close tolerances.



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CIRCLE INFORM-A-GRAM KEY NO. 161

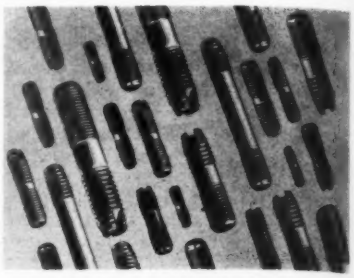
SELF-TAPPING STUD SPEEDS ASSEMBLY

A new double-ended stud that cuts its own thread when driven in an ordinary drilled hole, and locks securely in the same operation, has been developed.

The Schweppe Stud is a product of the Pheoll Manufacturing Co., 5720 Roosevelt Road, Chicago 50. It is a commercial stud which can be automated, since it can be located accurately from the slotted end to permit hopperizing for automatic feeding and driving at high speed with any power stud driver. No special adapters or attachments are required. The studs are reusable.

Only an inexpensive drilled hole is needed for driving Schweppe studs. Hole tolerance is not critical and no special hole preparation is needed.

Tapping, driving and locking are completed in one fast operation. Positive locking action of the stud assures highest resistance to vibration, stress reversals, and temperature changes under extreme conditions. An interference fit develops as initial threads on the stud engage tightly with mating threads cut in the hole, changing to a positive frictional interference locking action when final threads enter the hole.



Schweppe studs are made with hard, tough rolled threads in any desired styles at each end. At one end, a double threadcutting slot is milled in from opposite sides at an angle toward the end of the stud. The depth of the slot is the same as the ASA standard screw slot depth, permitting accurate location for automatic feeding and driving. They can be driven in steel, cast iron, aluminum, magnesium and plastic.

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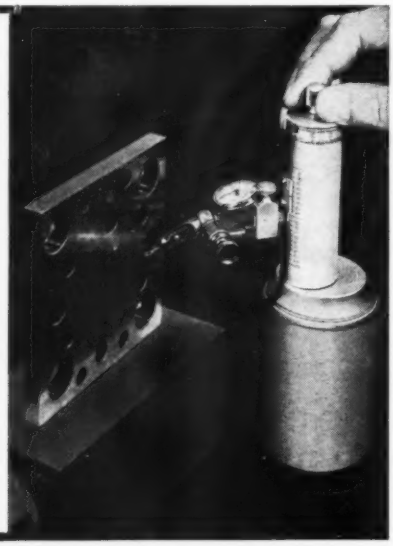

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CONTINUOUS HIGH PRODUCTION OF PRECISION FACING

A special Heald Bore-Matic developed for precision facing automatic transmission parts and geared to meet the high production requirements of the automotive industry provides continuous valve body production at a rate of 270 parts/hr at 75% efficiency.

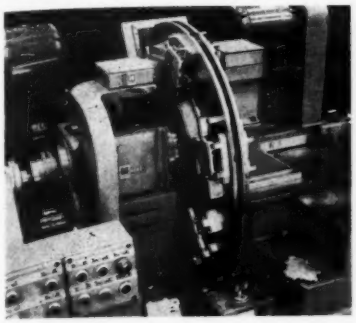
A constantly rotating trunion type fixture moves the parts in a circular path between and at right angles to the two boring heads. The boring heads are in opposed positions, and precision facing of two valve bodies clamped on either side of the fixture is done simultaneously. The 12-sta-

tion fixture rotates at approximately ½ rpm producing two finished parts every 20 sec.

Tooling consists of two multiple tool holders, each carrying eight single-point carbide facing tools. Boring heads to which tool holders are fastened are slide mounted (6" travel) for tool change or stock removal adjustment.

In normal operation, operator attention is limited to loading and unloading parts. Foot treadle operated fixture release leaves operator's hands free to unload and load sets of parts during a 60° segment of fixture rotation without stopping machine.

Raw parts pass through checking stations prior to machining. Micro switches connected to the checking mechanism stop fixture rotation if



part is improperly loaded or has excessive stock. Pushbutton reverses fixture rotation for repositioning or removal of defective part.

Convenience features of this machine include the ample work or part storage area at the right end of the base, an access door at the rear of the machine to facilitate machine setup, and a gravity chip chute fabricated into the base and inclined toward the rear of the machine. Cycle control is completely pushbutton.

From the machining standpoint, this Bore-Matic removes .050" stock (aluminum) and provides a finish of 20 micro or better with excellent flatness.

While this machine is primarily designed for manual loading and unloading, special conveyor and part handling equipment can turn this into a completely automated setup.

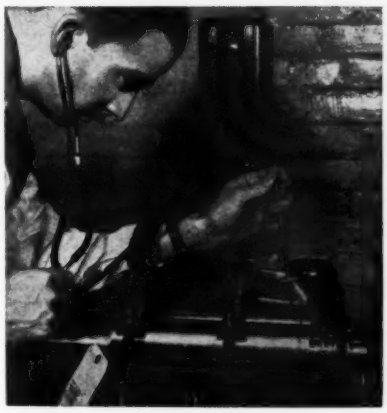
"As New" Granite Surface Plate Reconditioning

A service for the reconditioning of worn granite surface plates to "as new" condition has been established by the Rahn Granite Surface Plate Co. Not only is the surface relapped to "as new" accuracy, but the appearance is restored to "as new". This service is comparable to taking a planer cut on badly nicked iron surface plates before rescraping them. The granite surface can now be ground down until all nicks are removed. The charge is relatively small, based on thousandths of an inch per square foot, for the amount of granite that must be removed to clean up the deepest nick.

A few very large nicks, that would be impractical to grind out, are patched with a special cement that matches the color of the granite very closely. These patches can be noticed only on close scrutiny. A surface plate that "looks accurate", in addition to being accurate, will be given better treatment, and thus give longer service, than will a plate that looks bad. A precision tool must look precision in order to be given the treatment it deserves.

Rahn Granite Surface Plate Co., 638 N. Western Ave., Dayton 7, Ohio, will recondition any make of granite surface plate to any degree of Job Graded Accuracy required: toolroom grade .0001", inspection grade .00005", or laboratory grade .000025".

Bearings, Inc. . .



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Gentlemen:

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CIRCLE INFORM-A-GRAM KEY NO. 163

MEN YOU SHOULD KNOW

The promotion of **John Adamson** to staff assistant has been announced by **Ralph H. Isbrandt,** director of automotive engineering, American Motors Corp.

◆

Richard R. Kesti has been appointed chief engineer of both Valvair Corp. and Sinclair-Collins Valve Co. In his new post, he will head the general engineering divisions of these companies. He formerly was with Chrysler Corp.

Donald P. Ridgeway has joined the staff of Illinois Tool Works to fill the newly-established position of manager of the Spiroid Department. He will be responsible for the sales, engineering and production of spiroid gears. Prior to coming to Illinois Tool Works, he was employed by Janette Electric Mfg. Co.

◆

Andrew B. Huntington has been named chief engineer of Ross Operating Valve Co. He joined the company in 1952.

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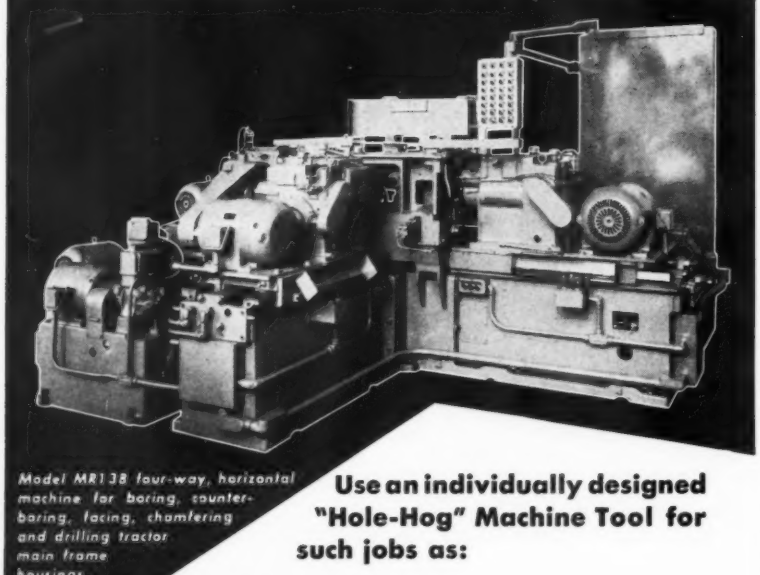

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- Adjustable Spindle Drilling
- Vertical and Way-Type Fixed Center Drilling, Boring and Tapping
- Special Multiple Operation Machine Tools

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MOLINE TOOL CO. "HOLE-HOG" MOLINE, ILLINOIS

Representatives in principal cities.

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MOLINE TOOL COMPANY
100 20TH STREET MOLINE, ILLINOIS

CIRCLE INFORM-A-GRAM KEY NO. 164

The appointment of **Jack Rosenberg** as manager of automation, Electronic Control Systems, Inc., an affiliate of Stromberg-Carlson and a subsidiary of General Dynamics Corp., has been disclosed. In this position, Mr. Rosenberg is responsible for the design, development and prototype construction of high-speed special purpose digital computers and controls for machine tools.

◆

Five promotions in the Telecommunication Division of Stromberg-Carlson, division of General Dynamics Corp., have been announced. **William A. Rockwood** has become assistant general manager of the division and **Harry M. Bruckart,** assistant to the vice president, responsible for the guidance of policy concerning dial switching systems. **Robert E. Dobbin** is taking over as chief engineer and **W. Wallace Weedfall,** as assistant to the vice president concerned with policy in regard to carrier, multiplex and microwave systems. **Malcolm P. Herrick** is assistant to the vice president dealing with policy in regard to industrial products.

◆

John A. Lindberg has been named manager of manufacturing operations for the entire division at the Mckintosh-Hemphill Division of E. W. Bliss Co. Mr. Lindberg replaces **Judson Neff** who resigned. **Thomas H. Pattison** has taken over as manager of the Pittsburgh plant, succeeding **Charles V. Wilt,** who retired from that position. Mr. Wilt will continue to serve as consultant to Mr. Lindberg.

◆

Dietrich Timmerman is the new chief engineer of the Rolling Mill Department of Birdsboro Steel Foundry and Machine Co. Before coming to the United States in 1951, Mr. Timmerman worked in rolling mill engineering departments of several German manufacturers and European steel plants.

◆

The appointment of **Murray D. Van Wagoner** to the board of directors of American Forging & Socket Co., has been made known by **Goodloe H. Rogers,** president. Mr. Van Wagoner is the former Michigan governor.

◆

Earl R. Lewis, Jr. has been named production manager of the cutting tool and gage divisions of Pratt & Whitney Co., Inc. He joined the company in 1940.

◆

John F. Zubrod has been named product manager of the air conditioning division of Whirlpool-Seeger Corp. He has been associated for some time with Servel, Inc.

MEN YOU SHOULD KNOW

E. M. Estes has become chief engineer of Pontiac Motor Division of General Motors Corp., according to an announcement by **S. E. Knudsen,** general manager and GM vice president. Mr. Estes succeeds **George A. Delaney** who will continue on the general manager's staff and handle special assignments.

◆

G. E. Hutchinson is filling the newly-created position of manager of quality control for Rem-Cru Titanium, Inc.

◆

Alfred D. Stevens is serving as assistant general manager of Willey's Carbide Tool Co. He is responsible for the newly expanded carbide metal manufacturing division. Mr. Stevens has had 13 years experience in industrial carbide development and manufacturing.

◆

Thomas S. Teague has taken over as manager of materials in the manufacturing section of the Metallurgical Products Department of General Electric Co. **Norman A. Matthews** has joined the department as a research engineer in connection with advance development. His new duties will involve researching in the field of special inorganic materials.

◆

John Wambold has joined the research staff of Kennametal Inc. as a metallurgical engineer, according to an announcement by **J. C. Redmond,** vice president-research. He formerly was with Curtiss-Wright Corp.

◆

The new general manager of the Cyclops Division of Universal-Cyclops Steel Corp. is **Elmore H. Broadhurst.** In his new capacity, he will assume full responsibility for all operating, administrative and technical activities of the division. He has been employed by the firm since 1936. **John P. Beal, Jr.** has been named production manager of the division. He will be concerned with the operation and production planning function of the division.

◆

Henry A. Lundy has been elected vice president of Hardinge Brothers, Inc.

◆

H. W. Loud Machine Works, Inc. has named **Nicholas M. Esposito** to fill the newly-created post of production manager. He is taking over full direction of the company's production planning, scheduling and control.

◆

Paul K. Dubin is now in the position of general works manager for Ulbrich Stainless Steels, Inc. Before joining Ulbrich Stainless Steels, he was employed by Wilbur B. Driver Co.

Wilbur H. Peter, Jr. has been elected vice president of Square D Co. and will also serve as manager of the Electric Controller Division. He succeeds **Alvin C. Dyer.**

◆

The election of **W. W. Gilmore** as vice president of Minneapolis-Honeywell Regulator Co. has been announced. He currently is president of the company's Micro Switch Division and will continue to hold that post. Mr. Gilmore came to the firm in 1941.

Three new vice presidents have been named by The Barden Corp. **Harold H. Gillespie** is serving as vice president and assistant general manager; **Emil J. Karkut** as vice president and factory manager; and **Raymond S. Mann** as vice president and personnel director.

◆

The new plant engineer of Electro Refractories & Abrasives Corp. is **William A. Snyder.** He is in charge of all design and new equipment engineering.

the new concept of vertical measurement is here
Webber Micro-Accurate
OPTICAL HEIGHT GAGE
This revolutionary new instrument will make micro measurements in the 1" to 61" range with an hitherto unknown overall accuracy of ± .000005" per inch.
These fantastic measurements are made speedily and easily by the average skilled workman.
Next to your Gage Blocks the new Webber Optical Height Gage will be the most useful tool in your shop. There is nothing like it in all the world.
Webber GAGE CO.
12903 Triskett Rd., Cleveland 11, Ohio
Webber Micro-Accurate Gages
LARGEST EXCLUSIVE MANUFACTURER
OF PRECISION GAGE BLOCKS

CIRCLE INFORM-A-GRAM KEY NO. 165

• *New Equipment*
• *New Materials*
• *New Literature*

WHAT'S NEW

Simple Die Setup is a feature of PE-64 preplasticizing-type injection molding machine. A new design heating cylinder provides for better plasticizing at lower temperatures. Features, specifications and a die space diagram are found in Bulletin 624 from Watson-Stillman Press Div'n, Farrel-Birmingham Co., Inc., 109 Aldene Rd., Roselle, N. J., or— **Circle Inform-A-Gram No. E1.**

Two New Low Toxic Hardeners for use with Epocast tooling plastics are now available from Furane Plastics, Inc., 4516 Brazil St., Los Angeles 39. Hardener 946 has a pot life of from 10 to 15 min and Hardener 986, a 25 to 30 min pot life, at ambient room temperature when used with surface coat resins, laminating resins and casting resins. **Circle Inform-A-Gram No. E2.**

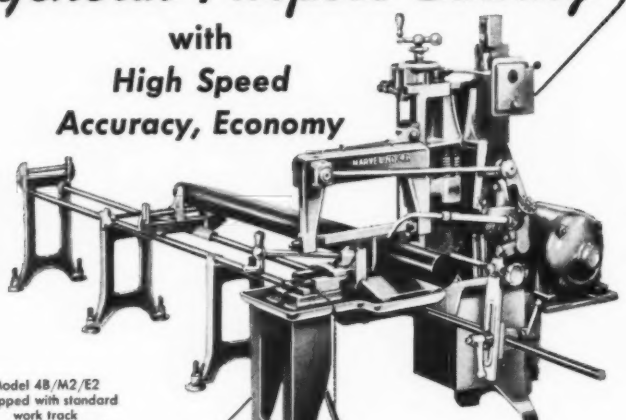
For...

General-Purpose Sawing

with

High Speed

Accuracy, Economy



Model 4B/M2/E2
Equipped with standard work track
(Optional Equipment).

Let us prove to you the many reasons why this MARVEL Hack Saw offers the cheapest, most accurate and fastest "cut-off" method available to you at a low initial cost.

Ask your dealer, or write us for Bulletin GP35 which fully describes and illustrates the many exclusive features which makes this Hack Saw Machine your "best buy".

MARVEL No. 4B
HIGH SPEED HACK SAW
Exclusive features

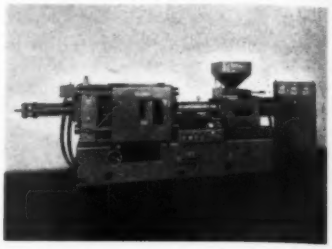
1. Horizontal Ball Bearing Saw Frame.
2. Screw Feed—Automatic or Hand Driven.
3. Quick Return Stroke—allows greater number of strokes per minute.
4. Simple Positive Coolant System.
5. Adjustable Stroke—can be shortened for larger capacity.
6. Speed Range—available in 1, 2 or 4 speed models for wider range of work.

MARVEL Metal Cutting SAWS
Better Machines-Better Blades

ARMSTRONG-BLUM MFG. CO. • 5700 Bloomingdale Avenue • CHICAGO 39, ILL.

CIRCLE INFORM-A-GRAM KEY NO. 166

This Plastic Injection Molding Machine features a heating cylinder that plasticizes up to 120 lbs of material/hr, tapered spreader design and four-zone temperature control. Model 275T-8/10 oz is 60% faster than the 10D-8 oz Reed which it replaces and its plasticizing capacity is 20% greater. Mold clamping stroke is adjustable between 6¼" and



10¼". Hydraulic die space adjustment facilitates mold setup. Injection speeds can be varied from 79.2 ipm with two booster pumps to 148 ipm using three pumps. The rate of injection is 800 cu in/min. This machine provides safety, rigidity and ease of maintenance. Reed-Prentice Corp., Worcester 4, Mass., or— **Circle Inform-A-Gram No. E3.**

An Automatic Injection Molding Machine combines vertical clamping with a horizontal combing action. The de-gated parts are ejected horizontally onto a conveyor instead of being dropped into bins. Either top or bottom ejection of the molded pieces is possible with two-ounce Model 701. This machine features a 3.5 sec automatic cycle. Its vertical design simplifies mold setup and makes easier the handling of inserts under semi-automatic operation. F. J. Stokes Machine Co., Inc., 5500 Tabor Rd., Philadelphia 20, or— **Circle Inform-A-Gram No. E4.**

A Summary of Plastic Tooling Information is found in "The Marblette Digest of Plastic Tooling." It covers the existing applications of plastic tooling for metal-forming and plastics-forming and in foundry practice. Data is provided on selecting suitable methods of constructing plastic tools, with descriptions of casting, laminating and combinations of these procedures. Short descriptions are included of the various thermosetting materials in the Marblette phenolic resin and Maraset epoxy resin lines. Also given are special-property hardeners and resin handling suggestions. Copies of the Plastic Tooling Digest can be obtained from Marblette Corp., 37-31—30th St., Long Island City 1, N. Y., or — **Circle No. E5.**

IN PLASTICS?

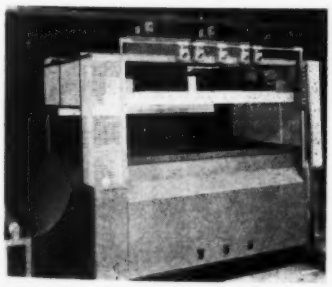
- *Plastics Fabrication*
- *Plastic Tooling*
- *Plastics Molding*

Plastic Tooling is detailed in a brochure made up of three bulletins published by Houghton Laboratories, Inc., 322 Houghton Ave., Olean, N. Y. The first of these bulletins, Bulletin 21, contains information on the process of making plastic tooling of all types by the epoxy laminate process. A description of epoxy type casting resins is found in Bulletin 22. In addition, the techniques for casting of all types of tools are outlined. In the last, Bulletin 23, are covered spinning forms. These forms are divided into three groups and each is thoroughly discussed. Also given in the brochure is comparative data on Hysol tooling materials. **Circle No. E6.**

Automatic Equipment for the preparation of reactive resin mixes has been announced by Applied Engineering Associates, 1952 Flushing Ave., Brooklyn 37. It is adjustable for a wide range of ratios and can be used with two or more components. Epoxies, polyesters, polyurethanes, polysulphides and polyamides are some of the reactive resin mixes that can be handled. Metered mix discharge can meet production demands up to 100 shots/min. Discharge pressures to 3000 psi are available. **Circle No. E7.**

A New Standard for Reinforced Plastic Sheets for mechanical and electrical applications has been adopted. A general-purpose grade of polyester glass-mat sheet laminates is covered. Copies of the GPO-1 Standard are available from The Society of the Plastics Industry, Inc., 67 W. 44th St., New York 36, or— **Circle Inform-A-Gram No. E8.**

A Special Design Automatic Drape-Forming Machine forms plastic shells for the new safety dashboard panels. The forming area is 48" x 72" permitting two dashboard



shells to be formed at once. The flexible plastic sheet material is fed into the machine from a roll. The Auto-Vac Co., 1984 State St. Ext., Bridgeport 5, Conn., or— **Circle Inform-A-Gram No. E9.**

A Modified Styrene Resin in pellet form has been developed for injection molding and extrusion applications by Goodyear Tire and Rubber Co., Chemical Div'n, Akron 16, O. The uniform size of Plio-Tuf P100 pellets permits accurate metered feeding and even distribution of heat through the materials. Details are in Tech Book Facts 56-65 thru 56-68. **Circle Inform-A-Gram No. E10.**

Vacuum Forming Equipment is covered in Catalog 661 issued by Formvac Corp., 601 W. 26th St., New York 1. Series "H" Formvacs feature adjustable stroke mold table and compact easy-reach design. The catalog details the features of the equipment and lists the standard sizes of Series "H" Formvac machines, complete with inside and outside views. **Circle Inform-A-Gram No. E11.**

Quick-Change...

Manchester Cut-Off Tool...

● New P.D.Q. "Manchester" cut-off tool offers *15 SECOND* tool change. Loosen only one screw to change carbide insert. "V" design on support blade and insert makes this tool self-centering and highly accurate. Adjustable rear stop provides positive insert backing and quick adjustment after insert is re-ground.

Tools are available for turret lathes, engine lathes, automatics and cut-off machines... Write for literature and specifications covering *ALL* the new "Manchester" tool features.

PDQ

PORTAGE Double-Quick TOOL CO.

1046 SWEITZER AVENUE • AKRON 11, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 167

James R. Phelan has joined Automotive Gear Works, Inc., a subsidiary of Eaton Mfg. Co., as a sales engineer. His headquarters will be in Richmond, Ind.

◆

Joseph Ellis has been appointed advertising manager for Micromatic Hone Corp.

Carl O. Newton will succeed **William J. Greene,** who is retiring, as vice president in charge of sales for The L. S. Starrett Co. Mr. Newton's former position of general sales manager will be filled by **Cortland A. Bassett.**

◆

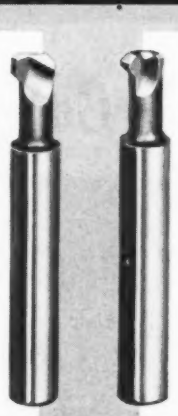
George M. Hartley is the new manager of marketing for the Metallurgical Products Department of General Electric Co. He succeeds **J. E. Weldy,** who recently was appointed a marketing consultant for the company's Marketing Services Division in New York. Mr. Hartley joined GE in 1946.

SPECIAL JOBS with STANDARD TOOLS

Thread Recessing

Bokum produces standard tools designed to give perfect threads in blind holes. These tools allow a run over with your threading tool or tap in production to help insure a perfect thread to the full depth of the hole. Most thread sizes are available. Write for Catalog T-R.

TR-3



Back Chamfering

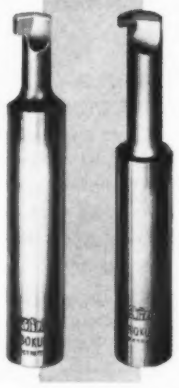
Here's another Bokum standard recessing tool. When you back chamfer a finished bore, you get a cleaner and easier cut off without a burr on the finished bored end of the part. Bokum produces these tools to conform to standard screw machine tool holder sizes. Write for Catalog B-CH.

B-CH-3

O-Ring Grooves

Bokum grooving tools produce the precise grooves needed for O-rings—meet the exact specifications of ring manufacturers. 15 different tools are available from stock for single O-rings, or for O-rings requiring one or two back ups. Larger diameters feature 2-piece construction. Write for Catalog O-R.

OR-103



Retaining Ring Grooves

Bokum produces a range of 29 tools to cut exact grooves for standard, inverted, bowed, beveled and self-locking retaining rings. 2-piece construction on larger diameters permits use of any length bar to compensate for the distance of the groove from the end of the work piece. Write for Catalog R-R.

RR-SV-46

TRADE MARK REG. U. S. PAT. OFF.

All tools available high speed steel or carbide tipped. All are standard tools—for economy!

BOKUM TOOL CO. 14775 Wildemere Ave., Detroit 38, Mich.

CIRCLE INFORM-A-GRAM KEY NO. 168

The appointment of **M. E. Dorman** as manager of dealer and accessory sales for the Die Supply Division of E. W. Bliss Co. has been disclosed. He has been associated with the company for 16 years.

◆

Cam Morawski has been named to the sales engineering staff of Detroit Broach & Machine Co. Mr. Morawski, who has been in charge of broach engineering, will be succeeded in that capacity by **Stanley Staton.**

◆

Byron E. Coon has been named general sales manager for Delta Power Tool Division by Rockwell Mfg. Co.

◆

Clearing Machine Corp., division of U. S. Industries, Inc., has named **Phillip Delmer** as manager of hydraulic press sales. His experience includes both sales and engineering in the power press and related fields.

◆

James D. Deneau has been promoted to Michigan district account executive for Bay State Abrasive Products Co. He has been an abrasive engineer for the company in the Detroit area since 1948.

◆

Paul S. Washburn has taken over as field engineer in the Pittsburgh district office of Norton Co. He joined the company in 1951. A new field engineer in the New England area is **Kenneth L. Bates.**

◆

The appointment of two sales managers to head distribution of gages has been announced by **C. V. Briner,** manager of the gage division of Pipe Machinery Co. **Wayne Burkhart** will serve as western sales manager and **William E. Hay** as eastern sales manager.

◆

Frank L. Kelsey has taken over as manager of the new Indianapolis district office of Niagara Machine and Tool Works. The announcement was made by **Franklin A. Reed,** vice president in charge of sales.

◆

The Herman Pneumatic Machine Co. has recently enlarged the territory covered by their representative, Edwin A. Swensson Co. of Detroit. **A. L. Redmond** will aid **Edwin A. Swensson** in handling the territory which now includes most of the province of Ontario, Canada, as well as Michigan and Toledo, Ohio.

◆

Russell V. Ringquist is serving as field applications engineer in the Midwest area for Firth-Loach Metals, Inc. His territory includes Illinois, lower Wisconsin, northern Indiana and Michigan.

◆

The newly created position of assistant sales manager for The Cross Co. has been filled by **R. T. Johnstone.**

MACHINABILITY COMPUTER SETS UP MACHINE STANDARDS

By applying old machining standards, it would have taken 244 min to machine a specific part in the Chicago plant of Scully-Jones & Co. Today, with new standards furnished by a machinability computer, the company is machining the same part in 166.20 min, or 77.80 min less time per part. This is a saving of roughly 17 hrs on 13 pcs.

The above example is one of many benefits Scully-Jones is deriving in using the new Carboloy machinability computer to short-cut time consuming procedures in setting up machining standards.

Besides increasing overall production on short-run jobs, the company also is uncovering and correcting discrepancies in established standards, verifying correct standards, bringing machine downtime under closer control, modifying quickly established operating standards where necessary, establishing new standards quickly on new jobs and educating machine operators on proper machining practice.

Because of the variety of work handled, output rather than tool life is more essential in the Scully-Jones plant. In the past, Erwin Kambeitz, chief standards engineer, says the procedure of setting up standards on a new job was based on operator or records of past experience. Both sometimes were costly from the "cut and try" standpoint, and the fact all information needed was not always available.

In addition, the company found that in spite of records, it was difficult to pin down standards among experienced machine operators since "no final authority" could be turned to under certain circumstances where one man's experience was as good as another's.

Several months use of a Carboloy machinability computer changed the situation. Machine operators look upon the instrument with new respect, they have come to lean on it as the final authority. It has made them more aware of the variables in machining practice and, as a result, fewer details are overlooked in setting up a new job.

As an added benefit, the instrument provides the plant with more flexibility in the use of its machines. For example, the job mentioned above, because of structure requirements, calls for machining expanding shells of the company's Roll Lock arbor from a solid upset forging.

The job could be machined more economically on a saddle type turret lathe with more horsepower and proper tooling. But since a No. 5 Gisholt ram type turret lathe was the only machine open, and the job had to be started immediately, the nod went to the Gisholt.

Use of the computer quickly determined the optimum speeds and feeds possible on the machine. After compensating for such job conditions as rigidity, etc., the final standard was quickly determined.

Feeds and speeds of high-speed cutting tools also are handled by the computer. Even boring cuts, taken with a single-point carbide tool were improved, in spite of the free overhang of the boring bars which presented a tool chatter problem.

ROTARY SWAGING

is fast and economical

A wide variety of work can be performed by Torrington Rotary Swaging Machines—with unusual speed and economy.

The swaging time to shape this section of 1⅛" tubing is only 6⅝ seconds. And the operation is easily and accurately performed by unskilled labor.

If your operations include reducing, tapering, pointing, sizing, bonding, forming inside contours or threads—rotary swaging offers many advantages over other methods.

Write today for our informative booklet on Torrington Rotary Swaging Machines. Or even better, ask to have a technical representative call to show you where rotary swaging can achieve new savings in your plant.

THE TORRINGTON COMPANY
Swaging Machine Division
6 North Street, Torrington, Conn.

Advantages of Rotary Swaging—

1 **Savings in material**—swaging is chip less—shapes the work instead of cutting metal away.

2 **Saving in labor**—swaging can be done by unskilled labor.

3 **Improved products**—swaging improves grain structure, tensile strength, resiliency and finish. Produces work accurate to ± .001" and better.

Torrington Job-Tested Swaging Dies—for the best in swaging machine dies—at economical prices, contact Torrington. All Torrington dies are job-tested before shipment.

TORRINGTON ROTARY SWAGING MACHINES

Makers of Torrington Needle Bearings

CIRCLE INFORM-A-GRAM KEY NO. 169

BIG RADIAL-ARM MACHINE SHAPES AIRCRAFT PARTS

Two new machines that should create a lively interest in many parts of the aircraft industry have been recently introduced. Use of these machines can help greatly to reduce costs and speed up production of large aluminum parts that have to be literally carved by hand from thick plates of the metal.

Many wing panels, slugs, doors, frames, ribs, spars, stiffeners, and other important airframe parts are made by simply cutting away large portions of an aluminum plate in order to leave the complex form desired. This calls for a machine with a high-speed spindle and a cutter capable of routing difficult contours and milling various shapes to different depths.

The new depth and contour mills, built by Ekstrom, Carlson & Co., Rockford, Ill., meet these requirements in a highly effective and efficient manner. The basic machine consists of a heavy column-like base carrying a sturdy, jointed, radial arm. At the end of the arm is mounted a high-cycle high-speed direct-drive cutter motor which is available with adjustable speeds as high as 14,000 rpm to as low as 3600. A T-slotted table under the arm holds the aluminum slab to be machined.

These machines come in two sizes, the difference being principally in the length of the radial arm. The No. 480 illustrated, is the larger of the two, with a maximum arm extension of 120" from column center spindle center. This machine has a 60" x 120" work table. The No. 484 is smaller, with a maximum arm reach of 60", and a 30" x 60" work table. The arms are so pivoted that they have an extensive swing at each joint, so that the cutter can be easily and quickly moved all over the work table area and some distance beyond.

An optional accessory with either machine is a canopy structure to which can be mounted an overhead templet. To use such a templet, an overhead follower is attached to the upper part of the outer arm so that it lines up directly with the cutter spindle. This follower is retractable and adjustable by a remote control hydraulic mechanism. Follower inserts can be selected to match cutter sizes.

The cutter motor is slide-mounted and independently adjustable for depth of cut by a separate hydraulic cylinder. For greater cutting power and lower maintenance costs, water-cooled motors are used. Other features include mist lubrication to motor bearings, double slides, four-position depth stops with micrometer adjustments, chuck nut or drawbar type collets, and many others.

STILL THE LEADER IN ITS CLASS!

5 TON
PRESS-RITE
POWER PRESSES

Compare Feature for Feature

. . . the features you'd expect to find only in the larger presses!

THEN COMPARE PRICE

$2670.00

(FOB St. Paul, Minnesota less motor & belt guard)

Model O 5-Ton Press-Rite

- **Special High-Strength Frame** with reinforcing ribs at all vital points.
  —Reduces die-wearing deflection.
  —Increases Production between die grinds.
  —Gives 2 to 3 times longer die life!
- **Special Bronze-Bushed Flywheel.**
- **Bronze Bearings** in both the main bearings and connecting rod.
- **Bronze Wear Plate** on back of ramways.
- **Greatest Shut Height** for their size! Permits using larger, more bulky dies.
- **Adjustable Ram Gibs** for more precise alignment.
- **Open Back, Inclinable.**
- **Single Stroke Safety** (may be quickly arranged for continuous operation).

10 MODELS: 2-Ton, 5-Ton, 10-Ton, 15-Ton, 20-Ton, 30-Ton, 37-Ton, 45-Ton, 60-Ton, and 85-Ton.

Write Today for Bulletin 955 and Name of your Local Distributor

Yes, Press-Rite Power Presses are built-for-the-job. Save money in your plant, switch to PRESS-RITE . . . Top buy in the field!

PRESS-RITE DIVISION

SALES SERVICE MACHINE TOOL CO., 2351 University Ave., St. Paul W14, Minn.

Used by more . . . for more production

PRESS-RITE

OPEN BACK • INCLINABLE *Power Presses*

CIRCLE INFORM-A-GRAM KEY NO. 170

ELECTRIC CLUTCH IMPROVES TURRET LATHE PRODUCTION

Floor-to-floor time is all-important in the profitable performance of the modern turret lathe. Any benefits gained by today's high speeds and feeds can be dissipated quickly if the machine takes an excessive length of time to start, stop, or reverse. Waiting for a spindle to come to a stop from 800 rpm can hardly be classed as productive machine time.

Conscious of this fact, Gisholt Machine Company's design engineers have used Warner electric clutches and brakes for many years, making it possible to start, stop, reverse, and

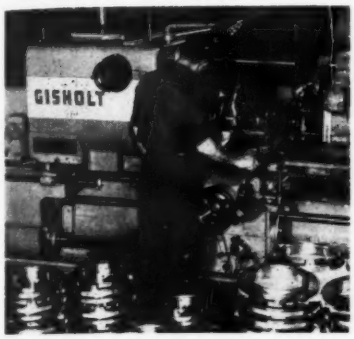
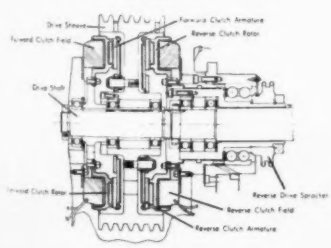


Figure 1

jog the spindles of their saddle-type turret lathes quickly and smoothly. Now, Gisholt is using the improved "RF" electric brakes and "SF" electric clutches built by Warner Electric Brake & Clutch Co., Beloit, Wisc.

These units have permitted extreme simplification of the drive systems on Gisholt saddle-type turret lathes (Fig. 1). The basic clutch and brake operating principle has done away with slip rings and brushes and the attendant maintenance. The self-adjusting features of the improved clutch and brake unit provides a longer service life before replacement becomes necessary. A constant running motor is belted to the main drive sheave by multiple V-belts (Fig. 2). Forward and reverse clutches are mounted on opposite sides of the main drive sheave.

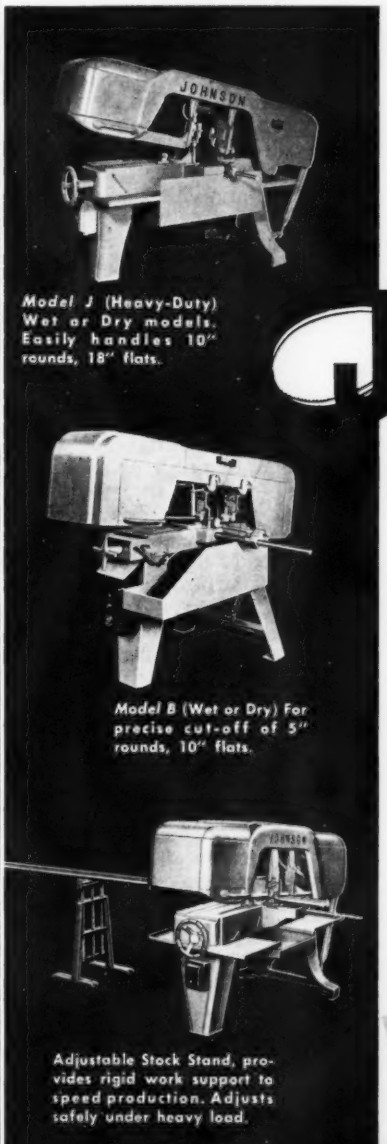
Figure 2



The forward clutch rotor is mounted to a special hub keyed to the drive shaft and, through gearing, to the machine spindle. The reverse clutch is keyed to a sleeve surrounding the drive shaft and carrying a chain sprocket, and it drives the machine spindle in reverse through a chain and gearing.

When the forward drive clutch is operating and reverse clutch is energized, the reverse clutch will act as a brake momentarily to decelerate the spindle, and then as a clutch to accelerate it in the opposite direction. The braking action is extremely fast, and the acceleration is exceptionally smooth. This design has brought a number of benefits to Gisholt users including: simpler control of actuating elements; fast reversing; precise inching control of the chuck; and reduced loading on the spindle motor because it runs continuously, rather than starting and stopping.

These Warner units have been improved with induced magnetic circuits, more compact design and thicker, tougher friction surfaces.


JOHNSON
Model J (Heavy-Duty) Wet or Dry models. Easily handles 10" rounds, 18" flats.
Model B (Wet or Dry) For precise cut-off of 5" rounds, 10" flats.
Adjustable Stock Stand, provides rigid work support to speed production. Adjusts safely under heavy load.

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If you've got a tough cutting problem in your plant, a Johnson Saw is your best bet to solve it. Controls are centralized, easy to reach. Set up is simple. Operation is automatic, and speed control variable. See for yourself how a Johnson Saw will save time . . . labor . . . and dollars in your own plant.

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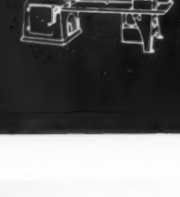

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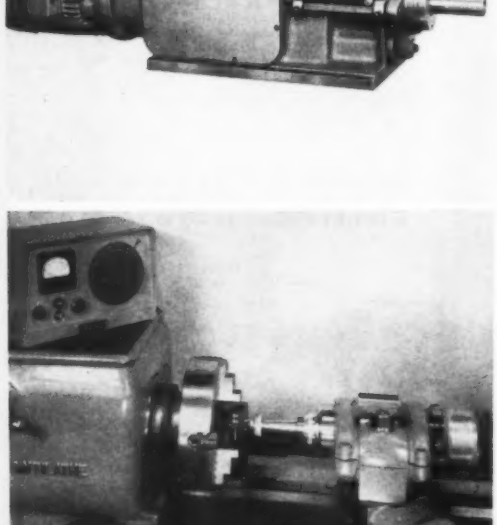
NEW DEVELOPMENTS • IMPROVEMENTS • COST AND TIME SAVERS

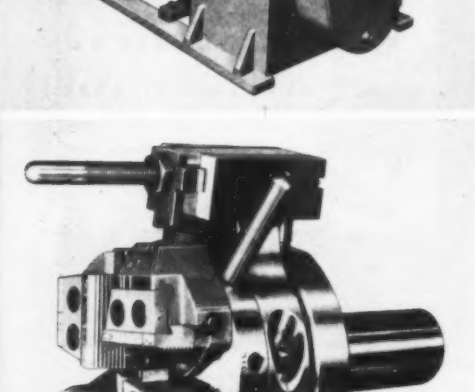


DRILLING UNIT . . .

Model 4000 cam feed drilling unit can be mounted in any position. Linkage and gear segment actuating means to the spindle quill are eliminated by a solid cam roller follower on the spindle quill. A single tool can be used in the spindle or a multiple head attached. W. K. Millholland Machinery Co., 6402 Westfield Blvd., Indianapolis 20, or — **Circle No. A1.**

POWER QUILL . . .

Specially designed mounts permit easy mounting of the Super 80 power quill to larger standard machine tools such as milling machines, tool and cutter grinders, etc., in single or multiple operations to tolerances of 0.0001". Provided is a continuously variable speed range from 7000 to 25,000 rpm. Precise Products Corp., Racine, Wis., or—**Circle No. A2.**



VERTICAL ROLLING MILL . . .

Designed for progressive compacting of metal powders is the No. 061 vertical rolling mill. It features the work rolls in a horizontal plane. Maximum separating force is 150,000 lbs. A four-speed drive permits rolling speeds from 5 fpm to 30 fpm. The Fenn Mfg. Co., Newington, Conn., or — **Circle No. A3.**

DIE HEAD . . .

A 5C Landmatic taper attachment die head has been developed for taper threading operations on No. 2 Brown & Sharpe and other small bar automatics. It has a ⅛" to ¾" pipe threading range. Landis Machine Co., Waynesboro, Pa., or — **Circle No. A4.**

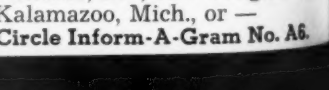
DRILL BLANKS . . .

H.S.S. drill blanks are now available in 182 standard stock sizes, including four standard sets, from Ace Drill Corp., Adrian, Mich. These blanks are ideal for use as knockout pins,

punches, dowel pins, gages and rollers for high temperature applications. They are also adaptable to form a wide variety of end-cutting tools such as routers, countersinks, spot facers, end mills, etc.
Circle Inform-A-Gram No. A5.

DUST COLLECTING UNIT . . .

Model 40 DusKolector is ideal for collecting dust from medium size grinding equipment. It will perform efficiently with drill presses, lathes, milling machines, surface grinders, etc., when these tools are used for high speed machining of cast iron. It is low in



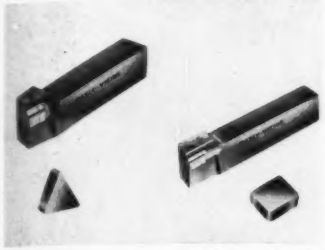
cost, compact and requires a minimum of space. Model 40 has a capacity of 700 cfm and can be used with two 16" x 2" grinding wheels or two 4" abrasive belts. Hammond Machinery Builders, Inc., 1631 Douglas Ave., Kalamazoo, Mich., or — **Circle Inform-A-Gram No. A6.**

ON PARADE

Mail FREE Inform-A-Gram Card for MORE Details.

TOOLHOLDERS . . .

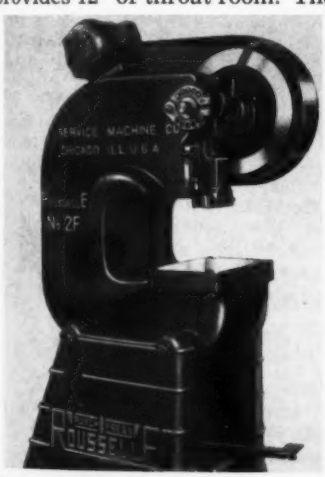
Two new types of toolholders for throwaway carbide inserts have been produced. They are designed to provide low cost, mass produced cutting edges for metal removal work. The toolholders provide positive insert



location, inexpensive interchangeable replacement parts and a wide selection of negative and positive rake holder styles, sizes and shanks. These toolholders and the throwaway carbide inserts also available, eliminate the need for grinding carbides to fit the job. Besly-Welles Corp., South Beloit, Ill., or — **Circle Inform-A-Gram No. A7.**

DEEP THROAT OBI PRESS . .

The advantages of an OBI press are combined with those of a deep throat unit in the 15-ton Rousselle Model 2F press. It provides 12″ of throat room. The



frame is heavily reinforced to assure high accuracy and uniformity of presswork. The press features 180 strokes/min with a 2″ standard stroke. It has a 11″ x 16″ bed area. For full details on the Model 2F press, contact Service Machine Co., 2310 W. 78th St., Chicago 20, Ill., or — **Circle Inform-A-Gram No. A8.**

KNOB SHOE ASSEMBLY . . .

A knob shoe assembly with "Snap on — Snap off" action is now being offered by Standard Parts Co., 1000 Broadway, Bedford, O. This assembly requires no pin fastening. It is designed to provide the greatest possible job clearance. **Circle No. A9.**

CYLINDER CLAMP . . .

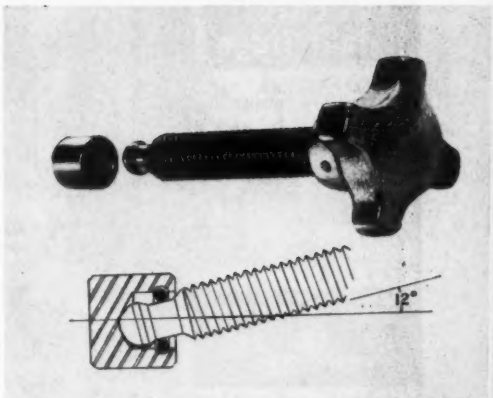
Triple-E 700-A cylinder clamp can be hooked into either an air or hydraulic line to operate. The unique device, connecting the cylinder to the clamp, allows the cylinder rod to travel in a straight line. E & E Engineering Inc., 15023 Harper Ave., Detroit 24, or—**Circle No. A10.**

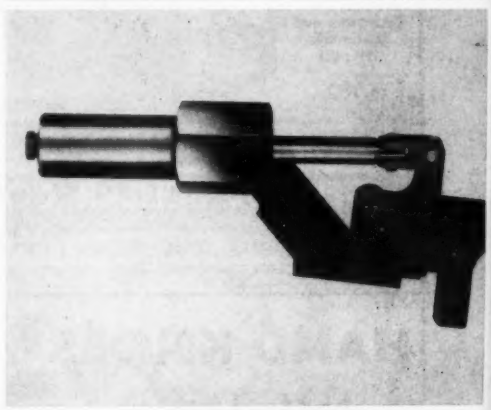
COOLANT SUPPLY UNIT . . .

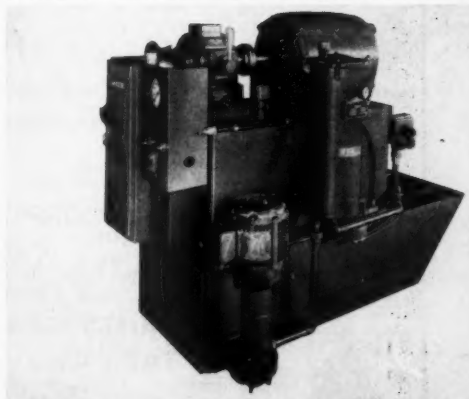
Automatic cooling, filtering and pumping of micro-clean coolant at pressures to 1,000 psi and volumes to 40 gpm are performed by this new unit produced by Sealol Corp., Warwick Industrial Park, Providence 5, R. I. It adapts standard vertical and horizontal drilling equipment for high-speed precision and deep-hole drilling. **Circle No. A11.**

COMPARATOR . . .

The electronic Accutron comparator is used for precision measurement and inspection in the shop, toolroom and gage laboratory. It is available in several standard dual amplifications. The gage head is adjustable vertically over a 6″ range. The Sheffield Corp., Dayton 1, O., or — **Circle No. A12.**







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The Most significant advance in a quarter Century of HEIGHT GAGE DESIGN

EASY READING 2-1/2" LONG VERNIER

RAPID QUICK ADJUSTMENT

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TRIANGULAR SCALE BEAM for Superior Strength and Rigidity, preventing sway and vibration.

Sizes Available 12" - 18" - 24" 40" - 48"

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HAND KNOBS
6 SIZES
CAST IRON

Tapped, Reamed or Blank.
Hex-shaped hub for extra tightening.

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DRILLS *from 2 to 7 holes*
TAPS *from 2 to 7 different sizes in one chucking*

JEMCO'S ARBO-2 fits any single spindle vertical drill press

all operations completed with one chucking — no reversing of drill spindle necessary for tapping — speeds changed quickly — reduces machining time-tapping capacity 1/8 to 9/16-drilling capacity 0 to 19/32

ARBO-2
automatic indexing turret type multi-spindle drill head

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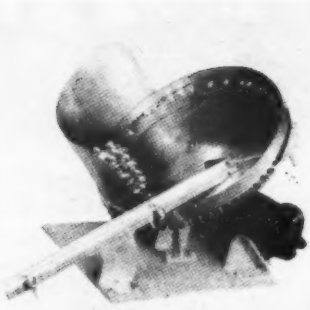
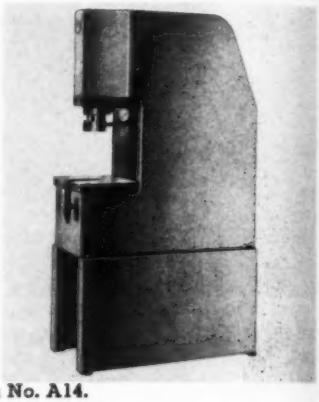
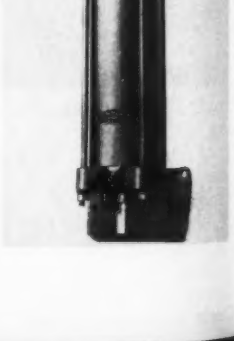


Orient and Feed Cup-Shaped Parts or parts with holes or other indentations by which the part can be picked up, with this pin hopper. It has a flat revolving plate inclined at an angle with spaced retractable pins around the edge. Speeds of up to 500 pcs/min can be obtained. U. S. Engineering Co., 40-24 - 22nd St., Long Island City, N. Y., or —
Circle Inform-A-Gram No. A13.



Two New Models have been added to the Proven Power hydraulic press 10 and 20-ton line produced by Northern Tool & Machine Co., 1545 N. 31st Ave., Melrose Park, Ill. These 7½ and 15-ton models are used for broaching, staking, forming, pressing, embossing, burnishing, etc. New construction has minimized shock and heat factors.
Circle Inform-A-Gram No. A14.

Loads Up To 500 Lbs are handled by this 26" air operated rotary indexing table, The Pitt. An adjustable hydraulic control assures cushioned stops under all load conditions. An indexing accuracy of ±0.0005" is featured. The table is available from 6 to 18 stations. Pitt Industries, Carnegie, Pa., or —
Circle Inform-A-Gram No. A15.



Reduce Punch Press Brake Wear caused by excessive brake pressure with Model L power press counter-balance cylinder. It also eliminates ram backlash and ram drop or over-ride due to its own weight. The counterbalance cylinder has universal installation application to all power presses. Dayton Rogers Mfg. Co., 2824 - 13th Ave., S., Minneapolis 7, or —
Circle No. A16.

ACCURACY .0002 T.I.R.

.0002 T.I.R. OR LESS AT SPINDLE NOSE, .0005 T.I.R. OR LESS ON TEST ARBOR SIX INCHES FROM SPINDLE NOSE

SPINDLE SPEEDS 150 and 250 RPM Other Spindle Speed Pulleys Available

MODEL B943 MOTOR DRIVEN WORK HEAD

No. 11 B & S Tapered Spindle Standard Equipment. No. 12 B & S or No. 5 Morse Available at Slight Extra Cost. Same Accuracy Guaranteed!

The B943 Motor Driven Work Head is a compact self-contained power unit for internal and external grinding. It is held in position by two T-slot bolts and can be mounted at any convenient spot on the table. The swivel base, which is graduated 90° one side of center and 45° on the other, permits the Work Head to swivel full 360° if desired. Swivel base can be easily removed from head permitting units to be mounted on table without base if desired. The B943 is easily and quickly mounted on other makes of grinders.

The No. 11 B & S tapered spindle, mounted on ball bearings, is hardened and ground, and is designed to receive chucks, collet fixtures, face plates, straight or tapered sleeves, centers and like equipment. Unit is grease packed at factory and requires no service in the field for the life of the bearings. Streamlined in design, this fixture is quickly mounted and is easy for the operator to keep clean.

The special motor is provided with conveniently located reversing switch which is handy for the operator regardless of the position of the work table or rotation of the work. Motor operates quietly and is fully protected from dust and from any oil entering from working parts.

See this extremely accurate B943 work head at your equipment dealer or write for complete literature.

K. O. LEE COMPANY

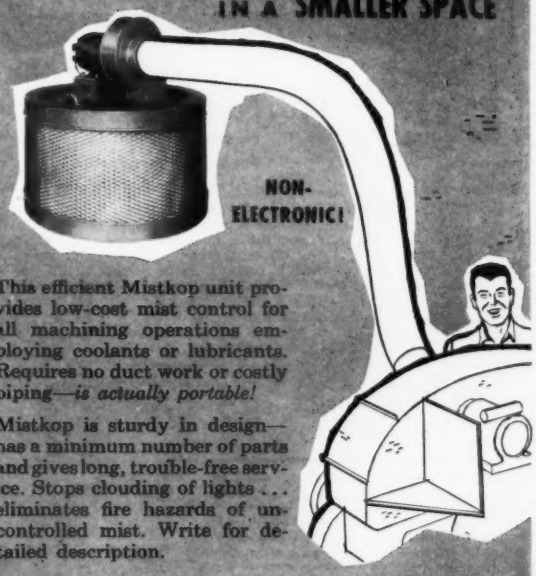
ABERDEEN, SOUTH DAKOTA

CIRCLE INFORM-A-GRAM KEY NO. 1751

MISTKOP

STOPS MIST

COLLECTS MIST-FOG EFFECTIVELY IN A SMALLER SPACE



NON-ELECTRONIC!

This efficient Mistkop unit provides low-cost mist control for all machining operations employing coolants or lubricants. Requires no duct work or costly piping—*is actually portable!*

Mistkop is sturdy in design—has a minimum number of parts and gives long, trouble-free service. Stops clouding of lights . . . eliminates fire hazards of uncontrolled mist. Write for detailed description.

AGET Manufacturing Company
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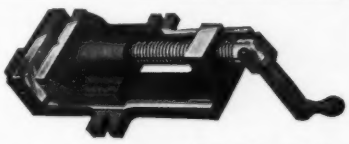

Cut Costs!

with the NEW YOST DRILL PRESS VISE

- Developed expressly for use on drill press operations.
- Does away with special and costly jig fixtures.
- Available in two sizes:

No.	Jaw Width	Max. Opening
1D	3½"	4 "
2D	5 "	5½"

Write today for bulletin on the extensive Yost line.

YOST MFG. CO. 124 Grant St., Cambridge Springs, Pa.

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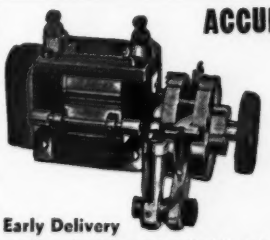

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Models to fit:
ANY PRESS
FOR ANY JOB
FOR STOCK UP TO 12" WIDE

Early Delivery on Standard Models

"RFC" ROLL FEEDS are quality built for long dependable service.

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Pawtucket, Rhode Island
An Electrix Affiliate

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AIR-MITE
HIGH PRODUCTION AIR PRESS
with more Quality Features

★ Solid Steel Column. Greater strength and rigidity.
★ Brass cylinder, aluminum end castings, Hy-Car piston cups.
★ Accurately ground table.
★ Fast set-up and stroke adjustment.

You don't have to "baby" an AIR-MITE Press because they're ruggedly built to stand the gaff of production work. From the tip of their solid steel column to the heavy base, they're every inch a workhorse tool. Feature-for-feature, you can't buy a better, more economical operating press than an AIR-MITE.

Special adaptations available. Write us your needs.

1 Ton Capacity
$89.95
F. O. B. Chicago

New 3 Way Control Valve. For safer, more efficient press work, use AIR-MITE Control Valves. Connected in parallel and positioned on either side of an air press, they provide a safe, instantaneous press operating control. Operator must depress both handles to actuate press . . . keeps attention on work-piece, hands out of the way. For pressures up to 160 p.s.i.

AIR-MITE Devices, Inc.
4417 W. CARROLL AVENUE, CHICAGO 24, ILLINOIS

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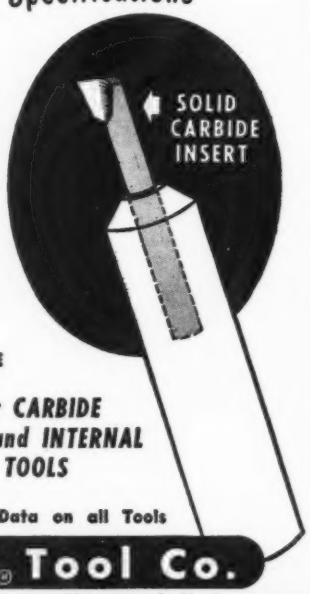
COMET® offers SOLID CARBIDE INSERT BORING TOOLS
Made to Your Specifications

FOR UTMOST PRECISION AND RIGIDITY, USE COMET® BORING TOOLS WITH SOLID CARBIDE INSERTS SET INTO STEEL SHANKS

SIZES FOR HOLES FROM 1/16" UPWARD



ALSO AVAILABLE
HIGH SPEED or CARBIDE BORING, FACING and INTERNAL THREADING TOOLS

Write for Complete Data on all Tools

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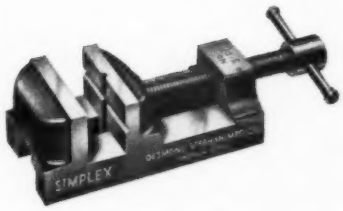
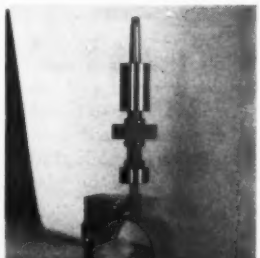
CIRCLE INFORM-A-GRAM KEY NO. 1762



Designed for Light-Duty Use in this Desmond Simplex No. 3-DP drill press vise. It has a 3" jaw width and a 3" jaw opening, with a jaw depth of 1½" and weight of 6 lbs. An overall length of 7 5/16" permits its use on small drill press tables. The Desmond-Stephan Mfg. Co., Urbana, O., or — **Circle Inform-A-Gram No. A17.**

Designed for Convenient, Efficient Operation is the Delta 20" drill press. The capacity of this portable single-spindle floor model is holes of 1" dia in cast iron and ¾" in steel in production operations. It can be obtained with or without a power feed attachment. This drill press is primarily a metalworking production tool. Rockwell Mfg. Co., 460 Lexington Ave., Pittsburgh 8, or — **Circle No. A18.**



A Tool for Chamfering and Deburring when producing holes in tubular parts ranging from ⅜" dia to 3" dia has been announced by Falcon Tool Co.,20771 Ryan Rd., Detroit 34. Any width of chamfer from 0.005" up, with any degree of angle, form or radius and also true concave or convex surface can be produced inside the hole. Burrs are removed inside and outside of any hole as well as any shape produced in the hole in one operation on a circular surface. **Circle Inform-A-Gram No. A19.**

Designed for Deburring and Finishing Small Parts is the Handee Slide-Abrader manufactured by Chicago Wheel and Mfg. Co., 1101 W. Monroe St., Chicago. The portable machine has a three-speed drive and automatic timer. Novaculite and all conventional types of tumbling media and compounds can be used with the machine. **Circle No. A20.**

new—
low cost

HYDRAULIC KEYSEATER

- fast set-up—saves time and money
- low cost operation—uses standard tool bits
- heavy-duty hydraulic circuit—assures accurate keyways
- compact, 21" x 61"—no special foundation
- versatile—cuts standard, tapered keyways; internal splines

ONLY WITH BLISS' new Hydraulic Keyseater can you get such a size range *from one machine*—¼" to 2" wide, to 12½" long, standard or tapered. It's easily set up for short or long production runs in small, medium or large plants, warehouses, maintenance departments. What's more, no foundation is needed. Speeds range up to 35 spm; heavy-duty hydraulic system is to JIC specs. All adjustments are readily accessible. Seven cutter bars, with standard tool bits, are also available. Special attachments permit internal spline cutting.

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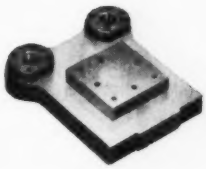
SINCE 1857

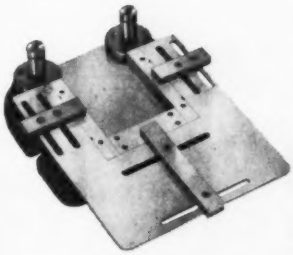
E. W. BLISS COMPANY
1132 North Seventh Street
San Jose, California

CIRCLE INFORM-A-GRAM KEY NO. 1771

Punches and Dies

Notching Die with Gauge Table





Standard stock sizes 4", 5" and 6". Lick those Notching Problems QUICKLY. Gauge table and gauging bars provide accuracy and speed with easy adjustment.

This is another of the many different kinds of punches and dies in stock or made to order for foot, hand or power operation. Precision made from high grade tool steel. Also adaptors and die shoes to convert your press.

Immediate Delivery

What are your punch and die needs? Consult us about your problems. Prompt service on "Specials" made to your order.

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STANDARD FLUSH PIN GAGES

Precision Built
of Precision Ground
Oil Hardened
Tool Steel

Can be Furnished with Indicator Mountings
Completely Ground to Your Specifications and Ready for Use
No Design Necessary
Deliverable from Stock

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Representatives Wanted for Most Industrial Areas

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PRESSURELOK-224
the best diamond wheel ever developed for carbide tool grinding. Guaranteed ultimate cutting life from each diamond particle in every wheel.

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1833 ILLINOIS AVE. AURORA, ILL.

US

IMMEDIATE DELIVERY on all wheel sizes. STRAIGHT, DISH, CUP, FLARE and MOUNTED WHEELS; HONES.

CIRCLE INFORM-A-GRAM KEY NO. 1773

Mold your own LEAD HAMMERS

COMPLETE LEAD HAMMER SERVICE

Here's the inexpensive, fast way of molding and remolding your own lead hammers with this COOK mold and ladle. It produces hammers that can "take it" Simple to operate.

Write for circular and prices

LAWRENCE H. COOK, INC.
68 MASSASOIT AVENUE, EAST PROVIDENCE 14, R. I.

CIRCLE INFORM-A-GRAM KEY NO. 1776

You Need an Extra Hand Now to Speed Up Production!

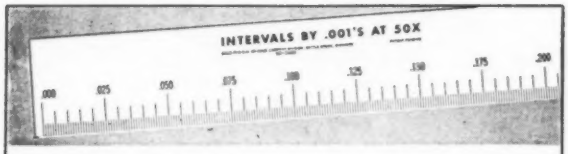
HEIMANN TRANSFER SCREW SETS

IN 11 SIZES No. 6 to 1" N.C. In all S. A. E. sizes.

Here is the *faster*, more precise way of transferring open and blind screw holes—make savings in "wage-dollars-per hour" of your expensive hands on every job. A die-and-tool maker's tool with many other applications for die makers and machinists. A set of 6 Hardened Screws nested in combination holder and wrench —no other tools needed. Get more work *now*—save money too!

HEIMANN MFG., CO. • URBANA, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 1777



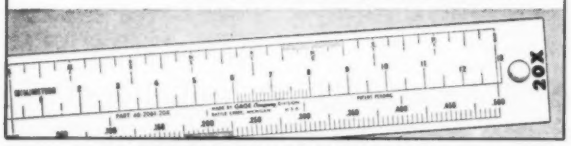
Gage Company PRECISION PLASTIC
COMPARATOR SCALES

Non-breakable...accurate...designed for making quick measurements at scale on projectors and comparators without any movement of machine or work.

An unexcelled tool for use in drafting and constructing scale layouts for comparator chart use. All standard magnifications and various styles for every application.

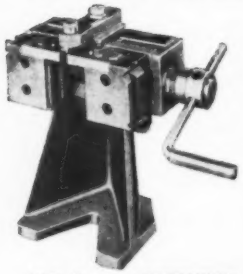
WRITE FOR BULLETIN NO. 54-1511

GAGE COMPANY
BATTLE CREEK, MICHIGAN



CIRCLE INFORM-A-GRAM KEY NO. 1781

SPEED UP DRILLING & TAPPING JOBS!



JOHN'S DRILL JIG

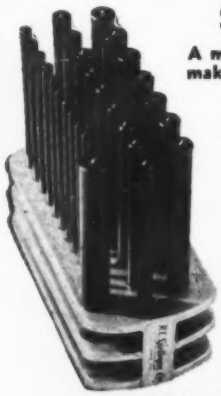
For cross or end drilling round, hexagon, or square stock or standard or odd-shaped rough castings from 1/8" to 8" O.D., the self-centering "John's Drill Jig" will cut tooling and production costs to minimum for 10 to 100,000 pieces.

Standard removable slip fit bushings and holders available to drill center or mean off-center. The self-centering action will hold within .0015" or better regardless of jig wear or piece part O.D. variation. Jigs available in three sizes 6", 8", 14"; jaw openings 2", 3¼", 7½".

Write for complete information.

HEUSER MANUFACTURING CO.
1642 N. Paulina St., Chicago 22, Illinois.

CIRCLE INFORM-A-GRAM KEY NO. 1782



SPELLMACO SPOTTERS

A matched set of transfer punches for toolmakers, machinists and tool cribs.

Used for transferring location of threaded, drilled and reamed holes, slugs, blanks, etc.

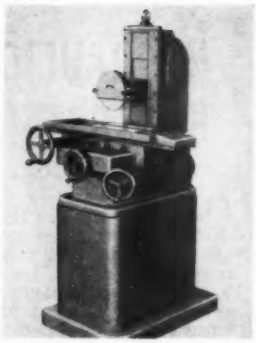
Precision made of finest tool steel carefully heat treated and tempered for long life. .0025 undersize to facilitate use—black oxide finish.

Set No. 3-17: 28 punches with indexed stand—Sizes 3/32" to ½" by 1/64" plus handy 17/32" size—length 4⅞". PRICE only $17.90

Single size available.

R. L. SPELLMAN CO. • Urbana, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 1783



A Variety of Toolroom Work is handled by a 6 x 12 hand feed surface grinder, Excel No. 7A. It is also suited to many production jobs. An elevating hand wheel is located below the level of the table. A timing belt drive actuates the table so that there is no rack and pinion, resulting in a smoother grind. Covel Mfg. Co., Dept. 739, Benton Harbor, Mich., or — **Circle No. A21.**

Automatic Feeding of Clinch Nuts is performed by this rotary type hopper. It is available in two hopper sizes, 18" and 24", equipped with either gravity or power feed. One or two tracks can be used on the 18" and up to 4 on the 24" hopper. Output per track ranges from 150 to 250 pcs/hr. Feedmatic - Detroit, Inc., 26901 W. 7 Mile Rd., Detroit 19, or— **Circle Inform-A-Gram No. A22.**

The Taper Design of this pusher enables the gripping surface to expand and contract within a range which fits both hot rolled stock and cold finished stock without change of pusher. The Burns taper lock pusher locks positively in forward direction and opens freely in the opposite direction. Allen Collet Mfg. Co., 17720 Clarann Ave., Melvindale, Mich., or — **Circle No. A23.**

Continuous Deburring of finish machined cast iron or nonferrous parts at rates ranging from 250 to 350/hr is possible with the new index-type in-line Burr-Blaster. It is designed for removal of fragmentary burrs. Modern Industrial Engineering Co., 14230 Birwood Ave., Detroit 38, or — **Circle No. A24.**

FRICTION SAWING with Tannewitz

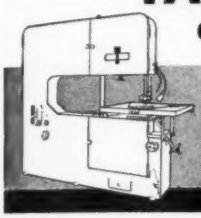
HIGH SPEED BAND SAWS

FASTEST, BEST MEANS OF CUTTING METALS

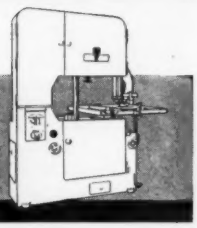
If you are not familiar with the advantages of friction sawing with these machines, by all means drop us a line asking for "Friction Sawing Data." You can save many times the cost of a Tannewitz High Speed Band Saw and greatly expedite production by using it to cut sheets of both hard and soft steel, formed or flat, trimming malleable and steel castings, cutting armor plate or many other materials. Write NOW!

THE TANNEWITZ WORKS

GRAND RAPIDS, MICHIGAN ☎ **GL-6-1729**



TANNEWITZ DI-SAWS — 24", 36", 48", 60" CAPACITIES
for CONTOUR SAWING, FILING, POLISHING
The smoothest, fastest, most trouble-free DI-Saws on the market. Write for bulletin.



CIRCLE INFORM-A-GRAM KEY NO. 1791

BRYANT TRUE GRANITE SURFACE PLATES

ROCK of AGES

Unequalled Wear Resistance!

All Bryant Surface Plates are manufactured from fine-grained *true quartz* granite. Their resistance to wear surpasses *all* other materials used as surface plates.

Patented "head of the grain" finishing process gives added assurance of retained accuracy through years of use.

Full range of sizes available from the same selected black-and-white true granite, in precision, standard and layout accuracies.

Convenient stands feature both utility and appearance.

Write for quotation, stating size and accuracy desired

BRYANT GAGE & SPINDLE DIVISION
Box 620-H, Springfield, Vermont

Granite Surface Plates • Groove Gages • Internal & External Thread Gages
Magnetic Drum Memory Devices for Computing Systems
DIVISION OF BRYANT CHUCKING GRINDER COMPANY

CIRCLE INFORM-A-GRAM KEY NO. 1792

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presenting...the NEW

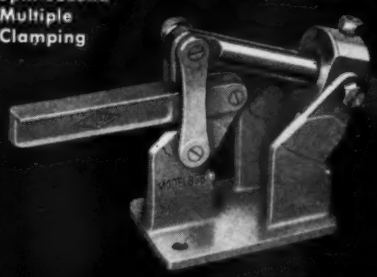
DE-STA-CO

Clamp-omatic

AIR OPERATED

TOGGLE CLAMP

for Positive Split-Second Multiple Clamping



MODEL **858**
18¾" long
5" high
4" wide

Holding Pressure to 2,000 Pounds with Normal Air Line Pressure of 90 Pounds. Weight 16 lbs.

- EXTRA HEAVY DUTY
- HARDENED BUSHINGS at all pivot points
- COMPONENTS EASILY REPLACED due to screw-type construction
- FORGED STEEL COMPONENTS

Write today for Literature on this new DE-STA-CO CLAMP-OMATIC, Model 858, as well as Models 810-U and 810-S.

DE-STA-CO **DETROIT STAMPING COMPANY**
WORLD'S FIRST LINE OF TOGGLE CLAMPS
344 Midland Avenue • Detroit 3, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 1793

ALL in ONE TOOLHEAD*

BORING
FACING
TURNING
GROOVING
UNDER CUTTING

SIX SIZES AVAILABLE

ALL HAVE POWER FEED FOR FACING

Model "D"

* A BORING HEAD THAT WON'T FACE IS NOT COMPLETE

WRITE for COMPLETE DETAILS

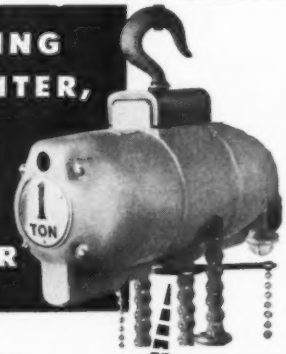
CHANDLER TOOL CO. Muncie, Indiana

COMBINED BORING & FACING TOOL HEADS

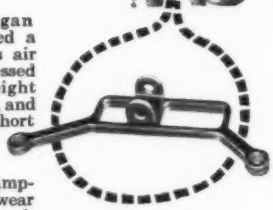
Chandler-Duplex

CIRCLE INFORM-A-GRAM KEY NO. 1801

D-R STAMPING PROVES LIGHTER, STRONGER, CHEAPER, FOR HOIST MAKER



A Grand Haven, Michigan manufacturer formerly used a cast control lever on his air hoists. Converting to a pressed steel stamping saved weight without sacrificing strength, and allowed him to order in short run quantities.



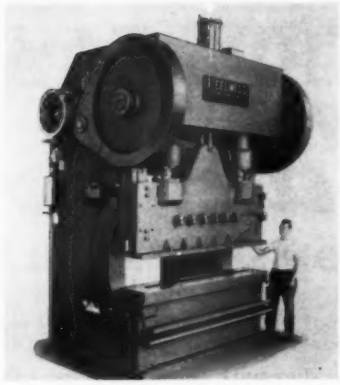
Dayton Rogers' small lot stamping service saves money, wear and weight, and improves product usage. Our facilities will handle blanks 22" square; material up to ⅜" thick; and draw operations up to 4¼" deep.

SEND YOUR SKETCH, BLUEPRINT OR PART, PLUS QUANTITY, FOR PROMPT QUOTATION

DAYTON ROGERS Manufacturing Company

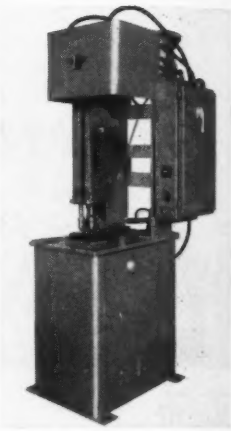
Minneapolis 7B, Minnesota

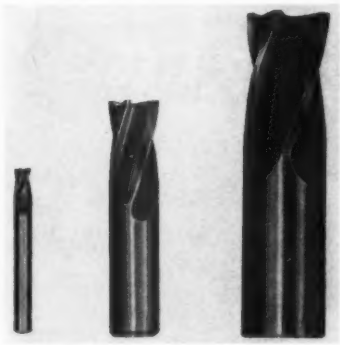
CIRCLE INFORM-A-GRAM KEY NO. 1802



A Press Brake Designed for Punching is now available from The Cleveland Crane & Engineering Co., Wickliffe, O. Shown is a 400-ton machine provided with a double-plate bed which has a 3" wide slot to receive punching slugs. It has a speed of 30 strokes/min with a 2" stroke.
Circle No. A25.

This Automatic Stud Driver, Model SD10-2, is easily adaptable to from one to three heads. Heads can be changed to a new pattern quickly, using new spacer bars from factory drawings. Since heads can be spaced as closely as 2½" center to center, they are easily integrated into automated index tables or conveyor lines. Syracuse Special Machine Co., Inc., 2900 E. Erie Blvd., Syracuse 3, N. Y., or —
Circle No. A26.



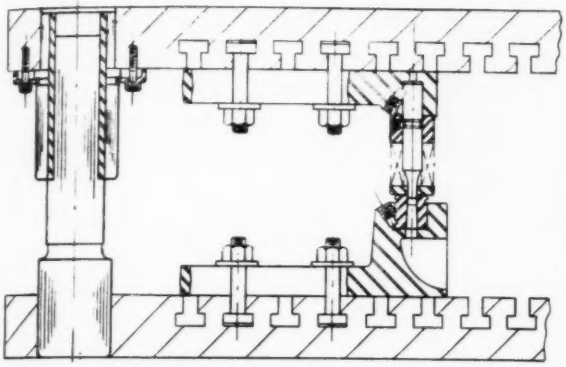


Production Jobs involving tough, abrasive materials are handled by solid carbide end mills. They are available in ⅛", 3/16", ¼" 5/16", ½", 5/8" and ¾" dia. For details, see Leaflet 165 provided by Severance Tool Industries, Inc., 730 Iowa St., Saginaw, Mich., or —
Circle No. A27.

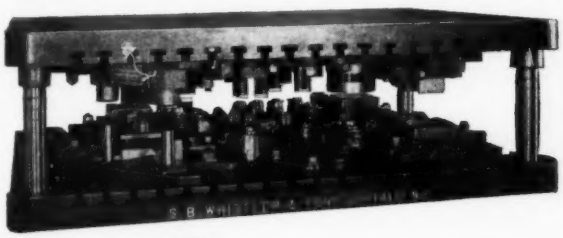
This Portable Hitch Feed Stock Reel is capable of handling small sized coils from 4" I.D. to 10" I.D. and weighing up to 50 lbs. Coils can be ¼" to 2½" wide. A time-saving feature is self-centering of the coil. Three sizes of side supporting discs are available — 16", 20" and 24". H. E. Dickerman Mfg. Co., 321 Albany St., Springfield, Mass., or —
Circle No. A28.

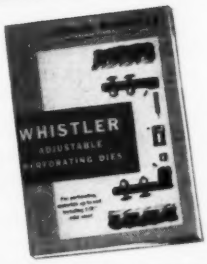
ADJUSTABLE DIES by WHISTLER

• Operate like a single purpose die • Easy to set-up and make changes • Interchangeable and re-usable parts always ready for a new job • Reduce die costs to a new low • Pierce holes in any desired arrangement of shapes and sizes • Precision piercing of materials to ¼" thick steel.



Above: Sectional drawing of a Whistler adjustable punch and die unit assembled in T-slot die set. **Below:** A completely assembled Whistler adjustable die ready for the press.





YOU NEED THIS CATALOG

to see for yourself in dollars and cents what this adjustable die making method can do for your plant. Send for it right now...without obligation.

S. B. WHISTLER & SONS, INC.
748 Military Road, Buffalo 23, N. Y.

ADJUSTABLE, MAGNETIC and CUSTOM DIES FOR ALL INDUSTRY
Direct Factory Representatives Located in Principal Industrial Areas

CIRCLE INFORM-A-GRAM KEY NO. 1811

UNIVERSAL
PARKSON GEAR TESTER
FOR SPUR - WORM AND
HELICAL & BEVEL GEARS
ABOVE PHOTO SHOWS SET-UP FOR WORM GEARS TO CHECK CENTER DISTANCE, CONTACT OF TEETH, RUNOUT, ETC.
CYLINDRICAL BUSHING
ADJUSTABLE V-BLOCK
Scale and Vernier, Ease of adjustment, Convenient Features to hold Worm and Shaft on V-Blocks or Bushing.
PARKSONS ARE MADE IN SIZES
9" - 15" - 24/30" — PLAIN AND UNIVERSAL
ASK FOR DESCRIPTIVE ILLUSTRATED BULLETIN
GEO. SCHERR CO., INC.
COMPLETE LINE OF PRECISION INSTRUMENTS
200-T LAFAYETTE ST. • NEW YORK 12, N.Y.

CIRCLE INFORM-A-GRAM KEY NO. 1812

Faster, Better, Less Expensive . . .

MARKING *with job designed*

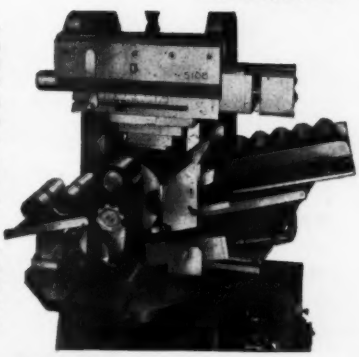
GEO. T. SCHMIDT

Production Marking Machines

The fully automatic, hydraulically - operated tube marker shown here was designed by GTS engineers for major automotive manufacturers.

The units roll a trademark and part number on 2500 to 3000 mild steel thin-walled tubes per hour — a speed that cuts cost per impression to the bone. Hydraulic control keeps all impressions clean, accurate, and of precisely the same depth.

Have a GTS Sales Engineer call on you, without obligation, to discuss how modern marking methods can save costs and speed production in your operation.



GEO. T. SCHMIDT, INC.
4112 Ravenswood Avenue
Chicago 13, Illinois

If It's Worth Making, It's Worth Marking

CIRCLE INFORM-A-GRAM KEY NO. 1813

MADE WITH "MEYCO" CARBIDE KNOW-HOW!

PRECISION CIRCULAR CUTTERS!

MEYCO carbide tipped and solid carbide cutters have earned an enviable reputation in plants where long tool life and precision workmanship is a MUST.

These cutters can be furnished in various diameters and thicknesses to meet the requirements of individual applications.

Saws and cutters, both carbide tipped and solid carbide, will aid production and precision in your slotting, venting, slitting and grooving operations . . . and they will be manufactured to your specifications. Please furnish complete specs and quantities desired when requesting prices and indicate material to be cut. MEYCO experience in the manufacture of precision tools, since 1888, is at your disposal. Write for Bulletin No. 51

ESTABLISHED 1888

W. F. MEYERS CO., INC., BEDFORD, INDIANA

CIRCLE INFORM-A-GRAM KEY NO. 1821

CUT PRODUCTION COSTS!

MARK NAME PLATES 5 TIMES FASTER

MODEL EMT-1

ELECTRIC TAG TYPEWRITER

A touch of the finger delivers up to 2 tons pressure for deep, legible impressions in metal or plastic tags.

—WITH— Automark ELECTRIC TAG MARKING MACHINES

MODEL SRST-2

HI-SPEED TAG MARKING MACHINE

Automatically marks BOTH constant and serial numbers at any desired speed up to 8,000 tags per hour!

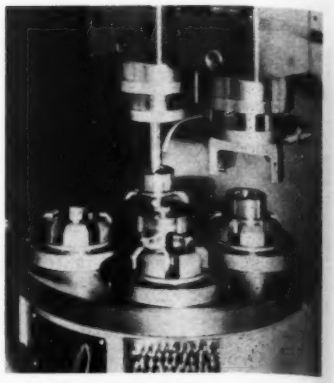
MANUFACTURERS' AGENTS Some Territories Still Available

Send Now for Bulletin

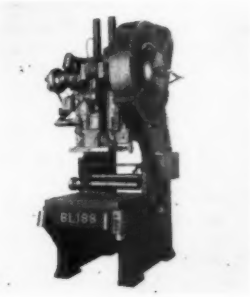
DEFIANCE MACHINE & TOOL COMPANY

1920 S. VANDEVENTER Dept. PT ST. LOUIS 10, MO

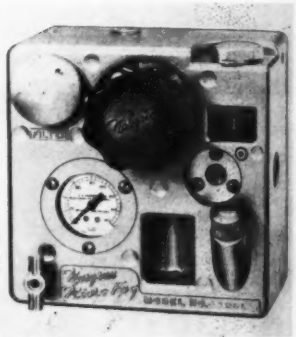
CIRCLE INFORM-A-GRAM KEY NO. 1822



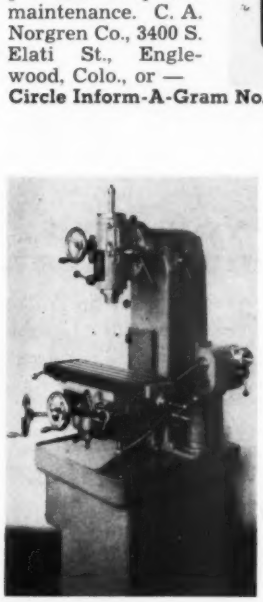
Accurate within 0.0005" of true position is Model AIT automatic indexing table. Designed to be used on the Wadell vertical precision boring machine for boring, drilling, turning or reaming, it can be adapted to other machine tools. The table is available in 12", 18" and 24" dia. Wadell Equipment Co., 119 South Ave., Garwood, N. J., or — **Circle Inform-A-Gram No. A29.**



Designed for Production of Aluminum Foil Products is the 21½-F foil press with a 50-ton capacity. A variable speed drive gives an operating range of 60 to 120 strokes/min. All important adjustments can be made from floor level. E. W. Bliss Co., 1375 Raff Rd., Canton, O., or — **Circle No. A30.**

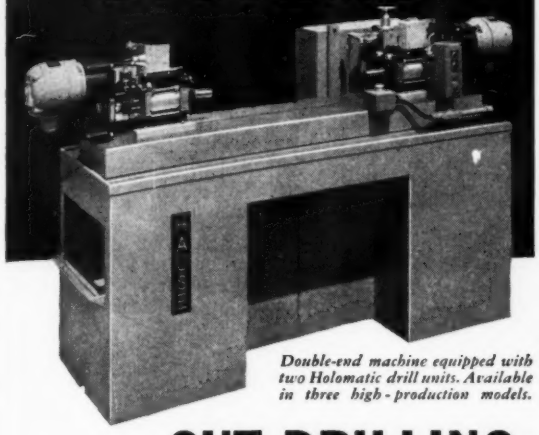


Model 33 AG-4 Lubro-Control Unit supplies air-actuated feed mechanisms, chucks, clutches, brakes, etc., with filtered air, regulated air pressure and Micro Fog lubrication. It provides simplified maintenance. C. A. Norgren Co., 3400 S. Elati St., Englewood, Colo., or — **Circle Inform-A-Gram No. A31.**



Automatic Longitudinal Traverse is a feature of Imperial Model M-1 milling machine. It has 6-automatic feeds ranging from 0.47 to 9.85 ipm. The vertical head swings up to 90° in each direction. The machine has direct electrical pushbutton control. In addition, special accessories are available. Aaron Machinery Co., Inc., 45 Crosby St., New York 12, or — **Circle No. A32.**

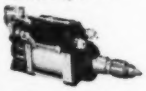
Holomatic SYSTEMS



Double-end machine equipped with two Holomatic drill units. Available in three high-production models.

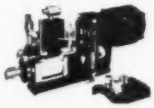
CUT DRILLING-TAPPING TIME

Model 24 — Holomatic Drill Unit Electric Motor Driven Spindle

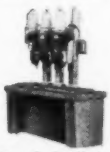


Model 14 — Holomatic Drill Unit Air Motor Driven Spindle

Model 24 — Holomatic Unit For Drilling and Tapping



Model 24—Holomatic for Deep Hole Drilling



Automatic Drill Press: Available in four base lengths with 1, 2, 3 or 4 Holomatic units vertically mounted.

● The modern high-production method for all automatic spindle type operations. Available as individual, self-contained power head units for installation on existing production machinery or as complete base-mounted machines with automatic controls.

Holomatic units operate on shop air line pressures for thrust and feature a self-contained hydraulic system for positive, accurate spindle travel and feed regulation. Traverse and feed rates are infinitely adjustable. Automatic, manual cycling, skip drilling, stops or dwell operations are easily arranged. Built-in air control valve simplifies set-ups and cuts installation time. Holomatic units operate efficiently at *any* angle.

Amazingly versatile, accurate, the Holomatic systems can be quickly and easily set-up for single or multiple operations. A Holomatic system in your plant will quickly and easily pay for itself through savings in time, money and tools.

Survey your production equipment now and visualize how easily and economically a Holomatic unit or complete system could boost your production rates.

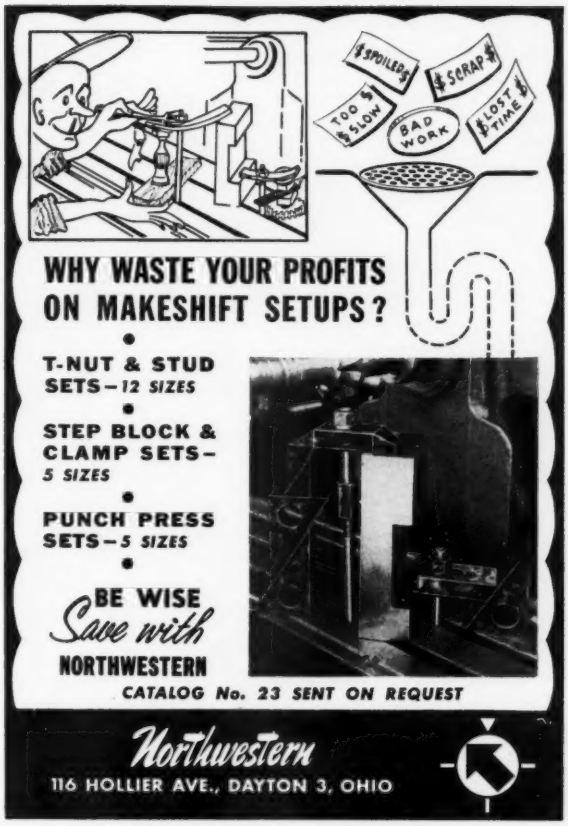
Write today for complete information, specifications and prices ... or, ask your Hause representative for an actual, obligation-free demonstration of the Holomatic System right in your plant!

Hause

ENGINEERING

MONTPELIER • • OHIO

CIRCLE INFORM-A-GRAM KEY NO. 1831



WHY WASTE YOUR PROFITS ON MAKESHIFT SETUPS?

●

T-NUT & STUD SETS — *12 SIZES*

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STEP BLOCK & CLAMP SETS — *5 SIZES*

●

PUNCH PRESS SETS — *5 SIZES*

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BE WISE *Save with* **NORTHWESTERN**

CATALOG No. 23 SENT ON REQUEST

Northwestern

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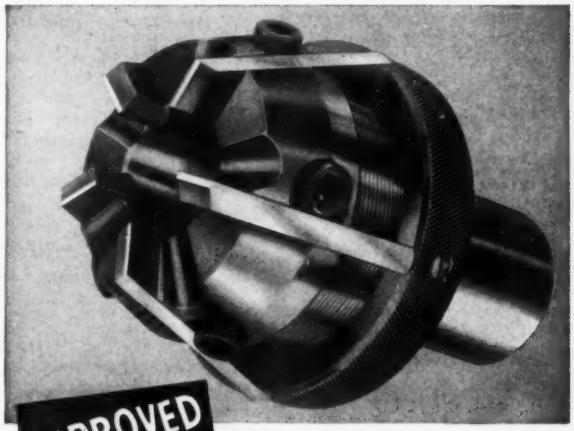

IMPROVED

GENESEE Adjustable Hollow Mill

There is a size and style Genesee for every hollow milling job. Standard sizes from 0 to 2", standard with straight or Morse Taper shanks carried in stock.

- **Quick — easy adjustment**
- **Simple sharpening method**
- **High speed steel—cast-alloy —Carbide tipped blades**
- **Let our Engineering Department solve your Production tool problems**

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GENESEE MANUFACTURING COMPANY

566 HOLLENBECK ST. • ROCHESTER 21, N. Y.

Adjustable Hollow Mills • Facing and Counterboring Tools • Special Production Tools

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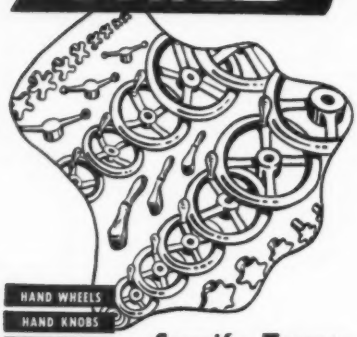
Tomco



HAND WHEELS
HAND KNOBS
MACHINE HANDLES
HANDLES
BALL HANDLES
SPECIALTIES

Specify Tomco for long lasting dependability

A complete line of high grade hand knobs, handles, and hand wheels is available from Tomco. Immediate shipments are made from stock of standard items. Specialty items are made to your specifications.

For original equipment or replacement parts look to Tomco for quality and service.

Write for literature

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1623 DOUGLAS AVE.
RACINE, WISCONSIN

Blank or Machined—from stock

CIRCLE INFORM-A-GRAM KEY NO. 1841

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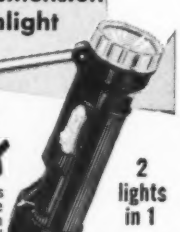
new amazing extension probe flashlight



usalite
DUO-FLEX

Powerful 1000 ft. beam plus flexible extension probe light for hard-to-reach dark spots. Uses 2 standard size batteries. Thousands of new industrial uses. Write for details, prices today.

2 lights in 1
No. DF-22
Pat.

U. S. ELECTRIC MFG. CORP.
222 W. 14th St., New York 11, N.Y.

CIRCLE INFORM-A-GRAM KEY NO. 1842

LIFTING DEVICES
for
FAST • SAFE • BETTER
Material Handling
of
• SHEETS
• COILS • BOXES
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• DRUMS • PALLETS
400 MODELS

Prompt Delivery
Write for full particulars

H. L. BUSHMAN CO. 100 West Central Ave. Roselle, Illinois

CIRCLE INFORM-A-GRAM KEY NO. 1843

FORD
rotary tools

WHY THEY DO YOUR JOB BETTER

All Ford files H. S. S. and carbide cutters are *precision machine ground* . . . which insures that tooth spacing is uniform and relief angles are constant on each tool. Ford files are handcut by precision craftsmen. On your job, that means more parts per grind. So you save labor on grinding and tool changing. You save on replacements. You save on downtime. What's more, there's less time per part, more parts per hour. In 7 shapes . . . cutting head sizes from 1/8" to 1" diameter, up to 1 3/8" in length. All standard, and *available* in H. S. S. or solid carbide.

Rotary FORD Tools

NEW CATALOG 601 FREE AND LATEST PRICES

. . . WRITE TODAY

M. A. FORD MFG. CO., INC.
817 W. RIVER STREET, DAVENPORT, IOWA

Precision manufacturer of Carbide End Mills • Countersinks • Grinding Burrs • Special Tools • Factory Regrinding

CIRCLE INFORM-A-GRAM KEY NO. 1844

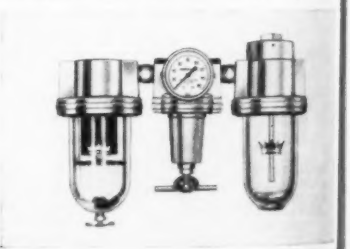
Permanently Mark, Engrave or Etch All Metals, ferrous or non-ferrous, with an electric vibrating pen. The Actograp Pen can be used to rapidly etch hard tempered steel,

monel metal, brass, copper, aluminum, tungsten, carbide, gold and silver. It can be used to mark delicate or massive sections. Newage International, Inc., 222 York Rd., Jenkintown, Pa., or —
Circle Inform-A-Gram No. A33.

A Holding Pressure of 400 Lbs is a feature of the "Midget" toggle pliers. The Wespo "Midget" pliers are 5¼" long and have a 1" opening

between jaws with a 1¼" depth of jaw. Weighing 5 ozs, these pliers are used for holding small pieces and for working in confined quarters. West Point Mfg Co., 26935 W. 7 Mile Rd, Detroit 19, or —
Circle Inform-A-Gram No. A34.

A New Line of Filters, Regulators and Lubricators has been introduced by Hannifin Corp., 564 S. Wolf Rd. Des Plaines, Ill. The Crown line is designed for use in compressed air



lines throughout industry. The units provide maximum air flow capacity for their rated pipe sizes. Shown is the "Combo," one of seven styles in five pipe sizes.
Circle Inform-A-Gram No. A35.

COMPLETE THE DIE-SET AT YOUR BENCH

Lacey Die-Set Machine

Here's a truly "one man" press. It operates with one hand. Handy for tool and press rooms, it permits the die-maker to complete a die-set at his bench ... saves toolroom and handling costs. Ask today for full details.

Sole Distributors

MOORE SPECIAL TOOL CO., INC.
726 Union Avenue Bridgeport 7, Conn.

CIRCLE INFORM-A-GRAM KEY NO. 1851

CUTTING THREADS?

CHASO'S chasers and self opening dieheads offer the fast economical way to do Production threading.

CHASO also manufactures chasers for most makes of dieheads thus offering a complete thread chaser service for whatever dieheads you have.

CHASO chasers are *guaranteed* to perform satisfactorily, and at a savings in your threading costs.

Write for complete catalog

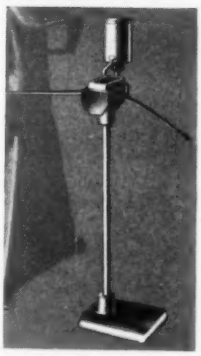
When you think of chasers think of CHASO.

MANUFACTURING CHASERS FOR 25 YEARS

CHASO TOOL CO. INC.
PHONE 2210
BOX 268A NORTH BRANCH, MICH.

CIRCLE INFORM-A-GRAM KEY NO. 1852

economically priced press room equipment



DURANT Stock Oilers

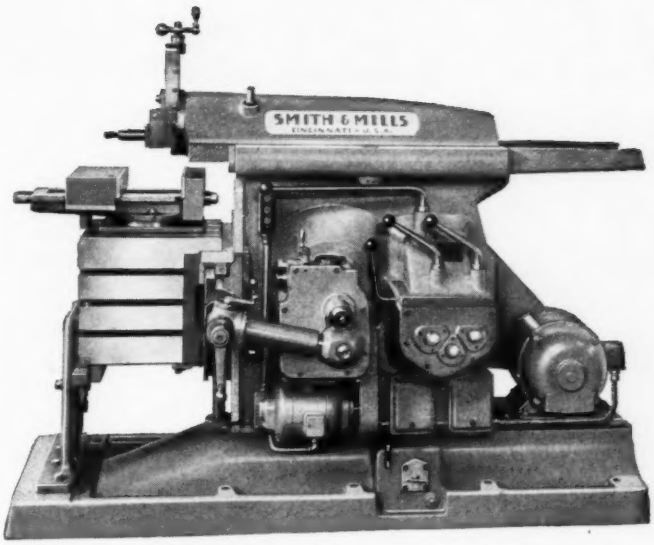
Available in five sizes —6, 8, 10, 12, 14 in. wide. Eliminates hand oiling. Prolongs die life, cleans and lubricates in one operation. Priced from $42.00.

Manufacturers of Stock Reels, Roll Feeds, Straighteners, Scrap Choppers, Die Pullers, Foot Presses, Coil Cradles, Press Guards, Stock Oilers.

WRITE FOR NEW FREE CATALOG

DURANT Tool Supply Co.
PROVIDENCE 3, RHODE ISLAND

CIRCLE INFORM-A-GRAM KEY NO. 1853



Bull ram gear, rocker arm and universal table trunnion made of ductile iron for extra rigidity.

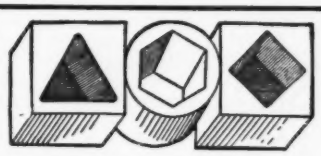
SMITH & MILLS SHAPERS— for production and tool room

Compare Smith & Mills with any other shaper for versatility, speed, cutting power and precision performance. *Compare* and you'll *buy* Smith & Mills—famous for high quality shapers since 1888. Write or wire for prices, deliveries, repair parts or field service. Smith & Mills Shaper Division, Nebel Machine Tool Corp., 3401 Central Parkway, Cincinnati 25, Ohio.

Smith & Mills Shapers now available in Heavy Duty Models in 16″, 20″, 25″, 28″, 32″ and 36″ strokes, and Standard Duty Models in 20″ and 24″ strokes.

Smith AND Mills SHAPERS CINCINNATI

CIRCLE INFORM-A-GRAM KEY NO. 1854



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BY A QUICK, EASY, INEXPENSIVE METHOD
Your business letterhead will bring literature.
WATTS BROS. TOOL WORKS
Wilmerding, Penna.

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HARDNESS TESTING
has been done with the SCLEROSCOPE
Since 1907

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THE SHORE INSTRUMENT & MFG. CO., Inc.
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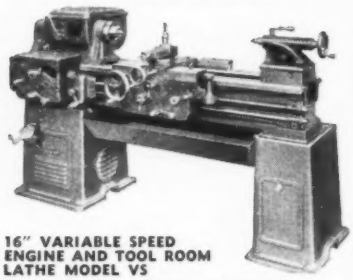
CIRCLE INFORM-A-GRAM KEY NO. 1856

Over Fifty Years of Lathe Building Experience

2 NEW C&J LATHES AT YOUR SERVICE!

A fitting climax to over half a century of progressive improvement in every detail of designing, engineering and construction. Worth looking into . . . sure to result in

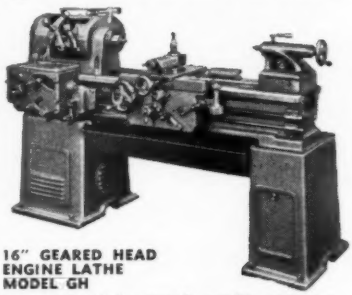
Fast, Accurate Turning at Lowest Costs



16" VARIABLE SPEED ENGINE AND TOOL ROOM LATHE MODEL VS

Standard taper key drive spindle nose.
Heavy duty Precision Timken taper bearings on spindle.
Infinitely variable spindle speeds from 30 to 1500 rpm.

WRITE FOR NEW BULLETIN A56VS



16" GEARED HEAD ENGINE LATHE MODEL GH

12 geared spindle speeds provide enormous pulling power. Choice of threaded or taper key drive spindle nose. Heavy duty Precision Timken taper bearings on spindle.

WRITE FOR NEW BULLETIN A56GH

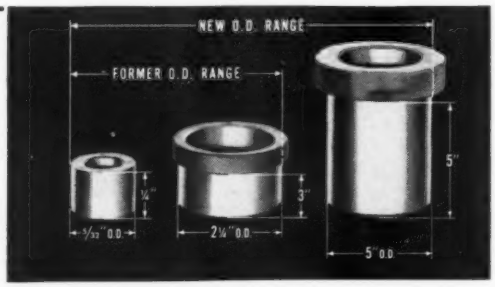
BOTH LATHES ALSO FEATURE:

- Separate rod for feed — lead screw for thread chasing only
- Heavy front and rear cabinet legs for maximum rigidity
- Extra length carriage — 23⅜ in.
- Wide range of threads and feeds — 48 separate threads 3 to 184 range
- Separate longitudinal and crossfeed lever controls employing positive type clutches
- Large crossfeed and compound rest dials

THE CARROLL - JAMIESON MACHINE TOOL CO. BATAVIA, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 1861

To Save You HOURS of Detailing Time...



A New Extended Range of O. D. Symbol Listings For ECONOMY *Bushings*

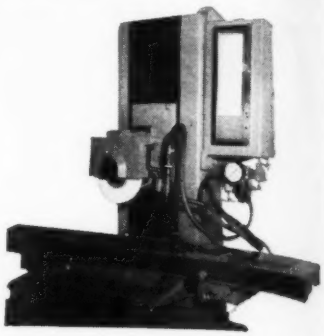
ECONOMY'S new "Dimensional Data Sheet No. 7-A" includes an *extended range* of Standard Drill Jig Bushings by symbol listings up to 5" O.D. by 5" in length. This eliminates all need for detailing. You specify by symbol and hole size only.

Ask for "Dimensional Data Sheet No. 7-A" TODAY!

ECONOMY TOOL & MACHINE COMPANY
1828 South 68th Street • Milwaukee 14, Wisconsin

CIRCLE INFORM-A-GRAM KEY NO. 1862

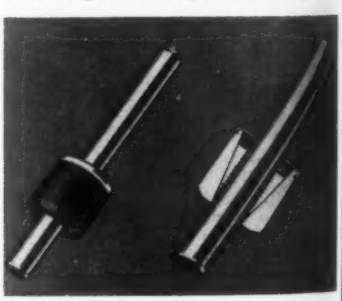
A New Cool Grinding Attachment features a compact design which enables the entire unit to be located on the grinder. A rectangular tank positioned on the side of the grinder



head column has a transparent face plate making the level of coolant visible. Operating air pressures are between 5 and 80 psi depending on spray desired. Reid Brothers Co., Inc., Beverly, Mass., or — **Circle Inform-A-Gram No. A36.**

Melco Center Point Lubricants have been designed for use on lathe and milling machine centers, grinding machine centers and steady rests and heavy journals. They are also used in tapping, broaching, extruding or any application where extreme pressure or frictional heat prevails. Only one application is necessary. These lubricants which are manufactured in both oil and grease form, permit higher speeds and heavier cuts. Work expansion will not affect their film. C. B. Teeter, 4470 Oakenwald Ave., Chicago 15, or — **Circle Inform-A-Gram No. A37.**

Wedgnuts which provide a fast way for fastening tie rods, eliminate the need for nuts, bolts, prethreaded bolts, lock nuts and lock wires. They have four parts — an outside internally coned shell that holds two precision tapered wedges and a cap that



keeps the two wedges in the outside shell. Wedgnuts are available in ¼", ⅜" and ½" sizes. No special tools are necessary for using them. Morrow Mfg. Co., Inc., R.F.D. No. 1, Old Baptist Rd., E. Greenwich, R. I., or—**Circle Inform-A-Gram No. A38.**

You Can Rely on a **ROUSSELLE**

THESE 40-TON PRESSES take job after job in stride and give you top speed and uniform output on a variety of work. They stress simplicity in every detail to achieve quicker set-ups, easier changeovers and simpler operation. All are extra rugged, high precision units, made to withstand hard usage and assure long, satisfactory service. They are *very moderately priced.*

Significant savings may result if you let our engineering staff assist you. There is no obligation.

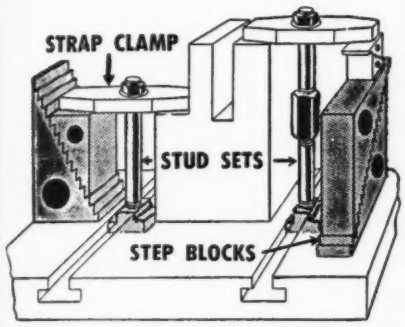
Rousselle Presses are sold exclusively through leading machinery dealers.

Choice of 25 models in 5 to 40-ton sizes.

Manufacturers of Rousselle Presses

SERVICE MACHINE CO. 2310 West 78th Street • Chicago 20, Ill.

CIRCLE INFORM-A-GRAM KEY NO. 1871



SURE-GRIP STEP BLOCKS

Clamping tools of all types.

Write for free tracing templates

TIETZMANN TOOL CORP.
Box 277
North Main St., Englewood, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 1872

DYKEM STEEL BLUE

Stops Losses making Dies and Templates

Popular package 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench; metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

Write for sample on company letterhead

THE DYKEM COMPANY
2303L North 11th St. • St. Louis 6, Mo.

CIRCLE INFORM-A-GRAM KEY NO. 1873

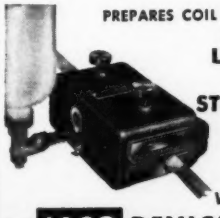
CAMS ALL TYPES MADE TO YOUR SPECS

Mfrs' agents wanted

Dr. Chas. Eisler ME, Founder
Chas. Eisler, Jr., Pres.

EISLER ENGINEERING CO., INC.
737 SO. 13TH. ST., NEWARK 3, N. J.

CIRCLE INFORM-A-GRAM KEY NO. 1874



PREPARES COIL STOCK FOR PRESS

New Low Cost
LIGHT-DUTY OILER-STRAIGHTENER
$95.00

Handles stock up to 3" wide, 1/16" (app.) thick

Write for details

JACO DEVICES, INC.
96 High St., Hingham, Mass.

CIRCLE INFORM-A-GRAM KEY NO. 1875

SPECIFY TOP QUALITY

DE-STA-CO

ARBOR SPACERS SHIMS and SPACING COLLARS • Arbor Spacers and Shims in 20 sizes and thicknesses from .001" to .125". Arbor Spacers furnished with standard keyway; Shims, with no keyway. Also Spacing Collars in numerous popular diameters, and in thicknesses from 1/8" to 3". Hardened and ground; edges chamfered. Furnished with standard keyway.

FEELER STOCK • Made from tempered stock, rolled to close tolerances, 1/2" x 25' coils packaged in transparent plastic boxes, except above .020". Strips 1/2" x 12", in cellophane. 27 thicknesses. All thicknesses from .001" to .032". (For use in precision fitting, checking clearances, inspection and production work.)

SHIM STOCK • Steel or brass. Selected from material rolled to precision limits, free from burrs, and protected by oil coating. Coils packed in carton for easy dispensing and protection. 15 thicknesses, .001" to .032". Sheets 6" x 12"; coils 6" x 120". Available also in two assortment packages —12 thicknesses, .001" to .015", and 15 thicknesses, .001" to .032".

DE-STA-CO

WRITE FOR Illustrated Brochure and Price List!

DETROIT STAMPING CO.

344 MIDLAND AVE. • DETROIT 3, MICH.

CIRCLE INFORM-A-GRAM KEY NO. 1876

Speed Versatility and Economy

Tooling costs go down when Speed Vise goes on the job because Speed Vise eliminates the need for expensive jigs and fixtures. Just a simple jaw plate to fit the part being drilled and Speed Vise does the rest. Several interchangeable Speed Vise jigs and fixtures can be made for the cost of one old style box type jig. The operation of Speed Vise tooling is many times faster than the operation of such conventional jigs and fixtures. Speed Vise tooling is economical to build, efficient to use, compact to store.

SPEED VISE GIVES YOU 100 JIGS IN ONE

$10.90 to $22.90

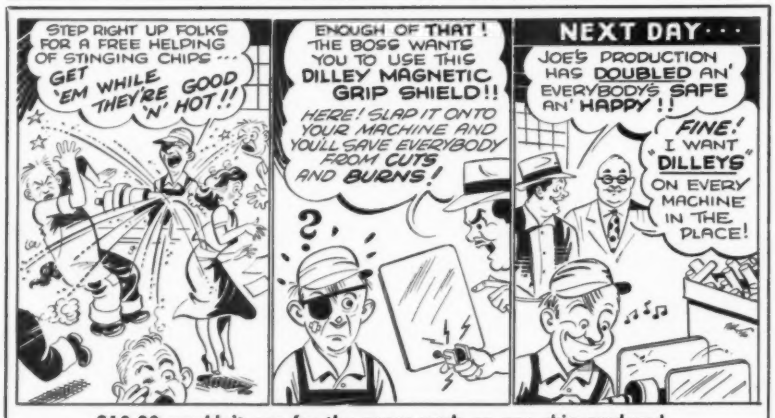
★ Quick action design for speed. Opens instantly to full capacity to handle work of any size.
★ Standardized holes for attaching jigs or jaw plates.
★ Lift...slide...lock...that's all there is to the fast, positive locking action.
★ Heavy, semi-steel castings for extra strength and a heavy base plate for rigidity.

Write or wire now for information

CARDINAL MACHINE COMPANY

1819 Dana Street, Glendale, California

CIRCLE INFORM-A-GRAM KEY NO. 1881


STEP RIGHT UP FOLKS FOR A FREE HELPING OF STINGING CHIPS ···
GET 'EM WHILE THEY'RE GOOD 'N' HOT!!
ENOUGH OF THAT! THE BOSS WANTS YOU TO USE THIS DILLEY MAGNETIC GRIP SHIELD!!
HERE! SLAP IT ONTO YOUR MACHINE AND YOU'LL SAVE EVERYBODY FROM CUTS AND BURNS!
NEXT DAY···
JOE'S PRODUCTION HAS DOUBLED AN' EVERYBODY'S SAFE AN' HAPPY!!
FINE! I WANT "DILLEYS" ON EVERY MACHINE IN THE PLACE!

$10.00 wouldn't pay for the paper work on one chip-produced accident in most plants.

Magnetic Grip-Shields are so reasonably priced your plant can't afford an accident.

You try 'em — You'll like 'em. The guard with 101 uses.

Write today for folder with prices.

THE DILLEY MFG. CO. 1633 Ansel Rd., Cleveland 6, O.

CIRCLE INFORM-A-GRAM KEY NO. 1882

Monarch Precision SHAPLANE Radius Tools

Illustration shows convex cutter for 1/4" to 2 1/2" balls.

FIVE MODELS for LATHES, SHAPERS, PLANERS, BORING MILLS

Range 1/2" to 3" for concave Radii. Also heavy duty models for radii to 6" on planers, etc.

PATENT PENDING

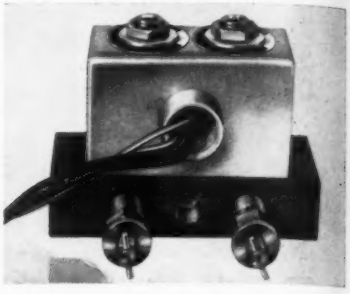
Write for circular

C. B. TEETER, TOOL ROOM SPECIALTIES

4470 Oakenwald Ave., Chicago 15, Ill.

CIRCLE INFORM-A-GRAM KEY NO. 1883

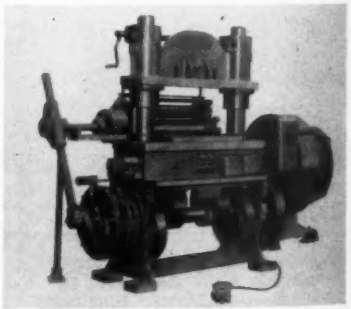
An Ultra-Compact Solenoid Control Valve has been added to the BV Series (¼" port size) air or hydraulic control valves produced by Modern-air Corp., 400 Preda St., San Leandro, Calif. It is available in both 3-way



and 4-way types. The valve is designed for use in oil hydraulic or air circuits operating at 50 to 150 psi.
Circle Inform-A-Gram No. A39.

Minimize Machining Time and Reduce Metal Waste with Ampco Metal Grade 18 stock hollow bars which are now available semi-finish machined. They are used in both production and maintenance applications as bushings, bearings and gears of all types. The hollow bars are also used for other parts where high strength, resistance to wear and fatigue, toughness and resistance to deformation under load are required. Ampco Metal, Inc., 1745 S. 38th St., Milwaukee 46, or —
Circle Inform-A-Gram No. A40.

Large Quantity Production of Aluminum Foil Containers is handled by the redesigned Multi-Max punch press, Model 5024. A roll reed is mounted on the bolster plate to feed aluminum foil coil stock 24" wide. The press has a 5" stroke and



operates at a variable speed from 60 to 125 strokes/min. Its open throat design enables feeding with a roll feed from front to back. Rated capacity is 50 tons. Diamond Machine Tool Co., 5111 Coffman-Pico Rd., Pico, Calif., or —
Circle Inform-A-Gram No. A41.

YESTERDAY'S PIONEER . . . TODAY'S LEADER

WELDON

Double-End End Mills

FOR DOUBLE DUTY

Weldon Double-End End Mills originally developed by Weldon give you double the service for much less than the cost of two single end mills of equal size. They save production time, too, because to change the mill you simply turn it end for end.

Weldon leadership in the cutting tool field has been achieved by many original features which contribute to faster, better performance and longer tool life.

Weldon distributors throughout U.S.A. and Canada carry complete stocks to serve you.

THE WELDON TOOL COMPANY

3000 WOODHILL ROAD . . . CLEVELAND 4, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 1891

THRIFTMASTER

your source for dependable

DRILLHEADS

Universal Joint Type Drillhead . . . Full Ball or Bronze Bearing Construction, Standard or Heavy Duty. From ½" minimum centers up. Capacities to ½" in Steel.

Gear Driven Eccentric Type Adjustable Drillhead . . . Enclosed, Full Ball Bearing Construction. Double Eccentric Type Adjustable Drillhead illustrated.

- We stock or can build the right drillhead for your jobs.
- Write for your free copy of the THRIFTMASTER CATALOG or phone for a rush, on-the-spot, quote.

Makers of
DORMAN AUTOMATIC REVERSE TAPPERS

Special Fixed Center Drillhead . . . Made to your requirements. Full Ball Bearing Construction.

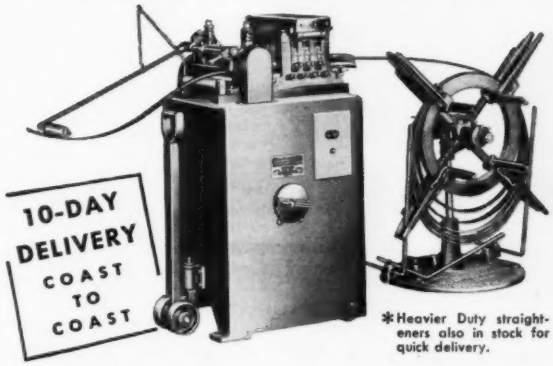
THRIFTMASTER
Products Corporation
A SUBSIDIARY OF THOMSON INDUSTRIES, INC.

1012 N. Plum Street
Lancaster, Pa.

CIRCLE INFORM-A-GRAM KEY NO. 1892

STRAIGHTEN COIL STOCK

from ½" to 8" wide...
from .018" to .065" thick...
on a LITTELL "308"*



10-DAY DELIVERY COAST TO COAST

*Heavier Duty straighteners also in stock for quick delivery.

Littell "308" Variable Speed Straighteners flatten coil stock...synchronize feeding of stock with speeds of automatic presses . . . simplify hand feeding. The "308" has brought new speed, efficiency and economy into stamping, blanking and shearing operations from coast to coast. Get full details on these portable straighteners.

Write for Catalog Section 3H

F. J. LITTELL MACHINE CO.
Speed with Safety

ROLL FEEDS • COIL CRADLES
STRAIGHTENING MACHINES
REELS • AIR BLAST VALVES
District Offices: Detroit, Cleveland

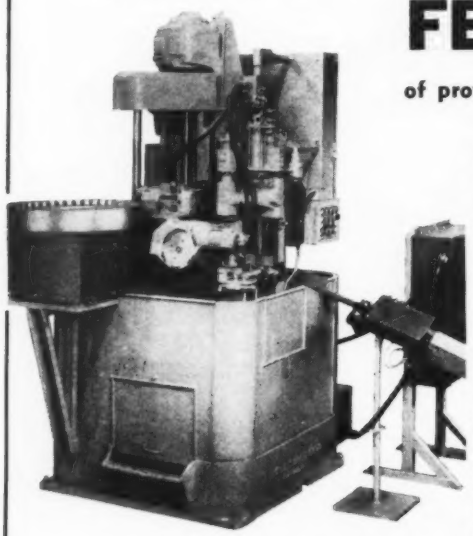
4197 N. Ravenswood Ave. • Chicago 13, Ill.

CIRCLE INFORM-A-GRAM KEY NO. 1893

SYNTRON

PARTS FEEDERS

of proven dependable quality



Syntron Parts Feeders provide an automatic controlled method of feeding small parts of almost any size, shape or material single file, in oriented positions at speeds to meet production schedules to placing devices, indexing tables, dies, marking table, etc. By means of a gravity fed track when it is necessary. This will cut production costs by increasing capacities of automatic installation. Electromagnetic, no wearing parts easy to install.

Syntron EB-2 Parts Feeder automatically loading single-spindle hobber.

For more information on how to cut production cost and increase capacities with Syntron Parts Feeders write for catalogue data free.

SYNTRON COMPANY
341 Lexington Ave. Homer City, Penna.

CIRCLE INFORM-A-GRAM KEY NO. 1901

REPUBLIC

TWIST DRILLS — REAMERS

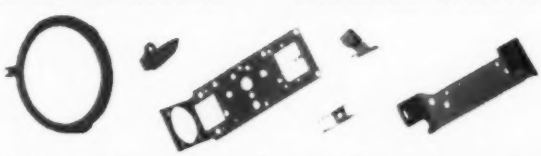
Whether it is for No. 40 holes in Titanium sheets for Jets or 1 3/16" holes in thick armor plate, Republic Drills give more holes per drill and more holes per hour of direct labor.

REPUBLIC DRILL & TOOL CO.
DIVISION OF AVILDSEN TOOLS & MACHINES, INC.
MAKERS OF "CELFOR," "CENTURY," "REPUBLIC" AND "U.S. EAGLE" BRAND TOOLS

NEW YORK PLANT
100 LAFAYETTE ST., NEW YORK 13, N. Y. 3 PLANTS — NEW YORK — CHICAGO — LOS ANGELES

CIRCLE INFORM-A-GRAM KEY NO. 1902

STAMPINGS - - - SHORT RUNS



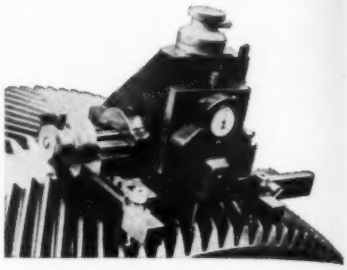
A dependable service for small quantity requirements for new developments and production up to 50,000 pieces. QUICK DELIVERY — ACCURACY — backed by 25 years' experience.

SMALL LOT STAMPING CO.

Linden 3-3700 "Dedicated to Short Runs" 1025 W. Blancke St. Linden, New Jersey

CIRCLE INFORM-A-GRAM KEY NO. 1903

Maintain Accuracy of Profile on large diameter gears within fine limits with a portable gear profile measuring instrument. The instrument will cover gears ranging from 18" to 16' or more in dia. It will also

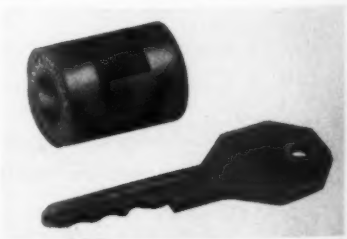


test spur or helical gears. The instrument is mounted on the gear by three spherical locators and six sets of locators, ranging from 5/16" to ¾" in dia, are supplied. Morey Machinery Co., Inc., 383 Lafayette St., New York 3, or —
Circle Inform-A-Gram No. A42.

A Double Solenoid Air Valve has been announced by Automatic Valve Co., 37415 Grand River Ave., Farmington, Mich. Model 2441-500 is a 4-

way, 4-port and 4-way, 5-port air valve, utilizing a spool type pilot. It is made in various sizes.
Circle Inform-A-Gram No. A43.

A Miniature Flexible Coupling has been developed for sub-fractional horsepower motors and other small units. Rated at 1/20 hp at 1750 rpm, the full range is from 0.003 hp at 100 rpm to 0.103 at 3600 rpm. The cou-



pling never requires lubrication. Lovejoy Flexible Coupling Co., Dept. TPC, 4801 W. Lake St., Chicago 44, or—**Circle Inform-A-Gram No. A44.**

HERE'S WHERE YOU MEASURE VALUE . . .

It's the quality of the production you get from South Bend 10″ Precision Lathes that's the measure of their value. Consistently close tolerances, regardless of the job, means a better end product for you, less scrap and lower costs. This is why you get more for your money in South Bend 10″ Precision Lathes. Write for catalog—base price $1174.

SPECIFICATIONS: *Engine* and *Toolroom* models. *Swing*—10⅛″. *Collet* capacity —1″. *Between Centers*—14 to 34″ max. *24 Spindle Speeds*, approx. 27 to 1400 r.p.m., with 2-speed motor.

A NEW CATALOG of 9″ to 16-24″ Lathes, Turret Lathes, Milling Machines, 7″ Shapers, 14″ Drill Presses, Pedestal Grinders. Ask for Catalog 5600.

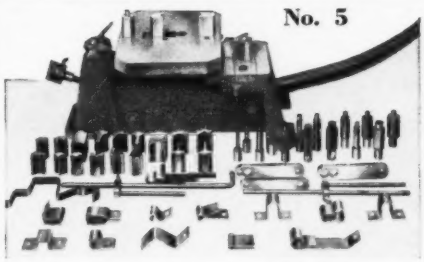
SOUTH BEND LATHE

SOUTH BEND 22, IND.

Builders of Lathes, Milling Machines, Shapers, Drill Presses, Pedestal Grinders

CIRCLE INFORM-A-GRAM KEY NO. 1911

No. 5



WRITE FOR DESCRIPTIVE CIRCULAR

Multiform

BENDER-CUTTER

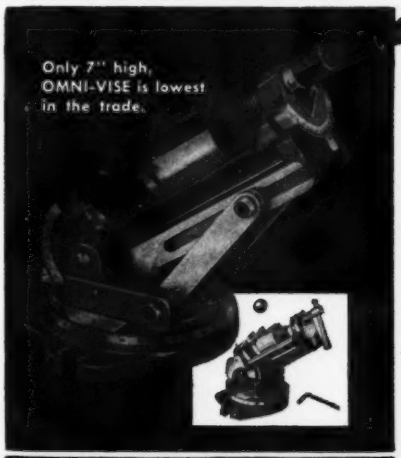
CUTS, BENDS, PUNCHES

Available in hand or air operated models, the MULTIFORM is shipped complete with full assortment of dies and mandrels to form and cut round or flat stock up to ⅛″x1½″ as illustrated. Punching and round end blanking dies available. Other models up to ¼″x4″ air operated.

ALSO AIR OPERATED MODELS

J. A. RICHARDS CO. KALAMAZOO, MICH.

CIRCLE INFORM-A-GRAM KEY NO. 1912



Hold any machine work at any EXACT angle with sturdy OMNI-VISE!

Accurately set in all three planes in only 15 seconds, this sturdy precision vise made in two capacities saves time and headaches for progressive shop operators and pays for itself quickly. Only 7″ high (lowest in the trade), **OMNI-VISE** #4, shown at top, is tough, weighs 74 lbs. Jaws are 4″ x 1½″, open to 4″. Base is 9″ in diameter with one side straight. Inset shows **OMNI-VISE** #2, a precision low-priced vise. Users find it exceptional for grinding compound angles on carbide tools. Weight, 16 lbs. Height, 4¾″. Jaws, 2⅛″. Opening, 2⅛″. Base, 7¼″ x 5″. For grinding, drilling or general work at any angle, by hand or machine, an **OMNI-VISE** is the machinist's choice.

Make any type spring, without arbors, FAST with Perkins Spring Coiler!

When you need a replacement or experimental spring, any shape, diameter or pitch from flat or round wire sizes .005″ to .125″, you can produce it in a matter of seconds with the new Perkins Precision Spring Coiler! You entirely eliminate the use of arbors, yet turn out precision springs — torsion, compression, extension tapered, or special springs — coiled either left or right hand, in any desired length, any diameter from 1/16″ to 12″ and larger, with or without initial tension, and with open or closed ends. Eliminate expensive special orders and costly production delays! Make your own springs to exact specifications for replacements or experimental work. Make them fast right in your own shop!

EXCLUSIVE DISTRIBUTORS OF PRECISION MACHINE TOOLS

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CONNORS AND DAVIS Sales Corp
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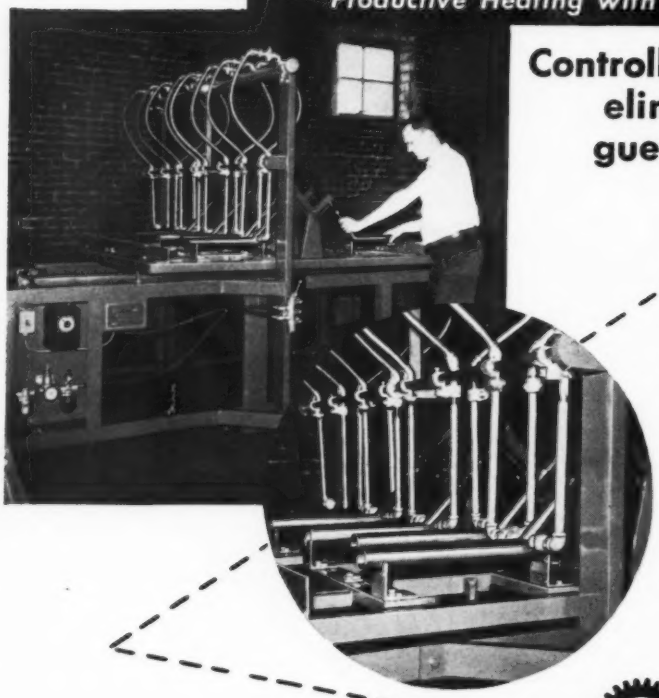
Please send detailed information and prices on:
PERKINS SPRING COILER hand ☐ power ☐
OMNI-VISE #4 ☐ #2 ☐
Name_____Title_____
Company_____
Address_____
City_____State_____

CIRCLE INFORM-A-GRAM KEY NO. 1913

Productive Heating with G.A.S.

Controlled Brazing eliminates guesswork!



THIS G. A. S. SHUTTLE TYPE UNIT silver brazes the backbone assembly of the newly designed trike of the AMF Junior Toy Company, Hammond, Indiana at high production speed; insuring absolute uniformity of braze and maximum strength. The operation includes joining of a 1-¼" tubular member to a 2" member. Production is facilitated by a set of six fixtures, which effects positive jigging of the assembly. This combined with closely controlled timing of the heat cycle, as well as controlled heat output of the burners, removes all guesswork from the operation greatly aiding speed and quality of production. Burners operate on a mixture of city gas and air at a fuel cost of only 30c per hour.

Ask for complete details on this and other G. A. S. Speed Heating Units.

GAS APPLIANCE SERVICE, INC.
Industrial Gas Engineers
1936 W. Balmoral Avenue Chicago 40, Illinois

CIRCLE INFORM-A-GRAM KEY NO. 1921

HEAVY-DUTY AIR (or Oil) CLAMPS

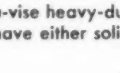
Never send a boy TO DO A MAN'S JOB

Design with clamps rated to the job they must do. Knu-vise heavy-duty clamps possess the extra margin of life needed because they're rugged, strong, built to stand abuse.

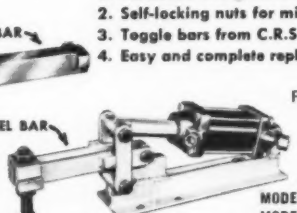
Knu-vise heavy-duty clamps are air (or oil) and hand operated —have either solid or channel bars. Featured are:

1. Hardened and ground bearing bolts
2. Self-locking nuts for minute adjustment of parts
3. Toggle bars from C.R.S. bars
4. Easy and complete replaceability of parts

SOLID BAR



CHANNEL BAR



Pictured are just two of several heavy-duty models available.

MODEL AO-400 (HD)—CHANNEL BAR
MODEL AOS-400 (HD)—SOLID BAR

⅛ ACTUAL SIZE

In a high production automobile plant, a Lapeer installation lasted for more than 1,300,000 cycles. After a small repair, the installation had passed the 2,000,000 mark and is still going strong. Better write today for complete information. No obligation, of course.

Manufacturers of over 150 models of manually and air-operated clamps and pliers

KNU-VISE PRODUCTS LAPEER MANUFACTURING CO.
3064 DAVISON ROAD • LAPEER, MICHIGAN
WESTERN DIVISION: 422 Magnolia, Glendale, California • CANADIAN DIVISION: Higginson Engr., Hamilton, Ontario

CIRCLE INFORM-A-GRAM KEY NO. 1922

Here's *NEW Speed and Economy* in HOLE SIZING and FINISHING!

BALLIZING is a high-speed, high-precision process for sizing and finishing holes—simply by pressing a suitably-oversize ball through the unfinished hole. It is used to advantage with holes from 1/16" to 5" diameter, in a wide range of metals—with production quantities from 1 piece to millions.

Rod (not shown) pushes ball through unfinished hole.
Precision ball of tungsten carbide, slightly larger than finished hole.
Hole before ballizing.

ADVANTAGES:

- FAST. Takes only seconds. Well suited to automation.
- ACCURATE. Produces uniform hole size.
- FINE FINISH—burnished smooth.
- ECONOMICAL. Replaces one or more machining, grinding or finishing operations. Uses unskilled labor. No tool sharpening. No close adjustments. No special or high-precision equipment required.

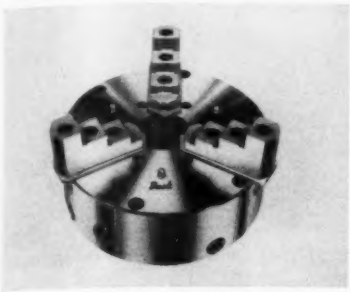
FREE BALLIZING BULLETIN gives details; shows typical applications. May we send you a copy?

INDUSTRIAL TECTONICS, Inc.
3699 Jackson Rd., Ann Arbor, Michigan
5020 E. Washington Blvd., Los Angeles 22

ITI
PRECISION BALLS OF ANY SIZE OR MATERIAL
ANTI-FRICTION BEARINGS FOR SPECIAL REQUIREMENTS
TOOLING BALLS — MASTER BALLS — SPHERICAL FINISHING

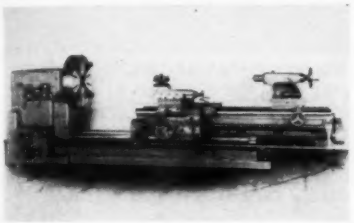
CIRCLE INFORM-A-GRAM KEY NO. 1923

A Dust Proof Chuck has been developed by Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich., for grinding machines and dividing heads, and wherever abrasive dust and metal chips are a problem. It permits using the full capacity range



of the chuck. Providing the same precision as all Buck Ajust-Tru chucks, this dustproof chuck with a hole through the center can be used dry or wet. Literature on the chuck is supplied by the company, or — **Circle Inform-A-Gram No. A45.**

Instantaneous Direct-Reading Selector for quick change gear box is a feature of Imperial Model PS-/34/61 lathe. Without transposing gears, 174 different standard threads



in the various systems can readily be obtained. For further details, contact Aaron Machinery Co., Inc., 45 Crosby St., New York 12, or — **Circle Inform-A-Gram No. A46.**

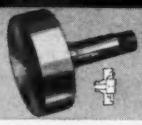
A Straightedge Counterbalance has been introduced by Mayline Co., 619 N. Commerce St., Sheboygan, Wis. It is essential wherever straightedges are used on a steeply inclined

surface or on a vertical board. The counterbalance can be used with Mayline and any other straightedge using the under board type attachment. **Circle Inform-A-Gram A47.**

Specify KASSON Precision Collets and Attachments

3AT, 3C, 1A, 4C, 5C

480 (AC-30) PUSH TYPE. All collets in hexagon, square and round for lathes, milling machines, attachments.



KLUTCH-KOLLET Step collet. Accurate chucking to 2¼" dia. Soft head for easy boring. Lowest price on market! Models 3AT, 3C, 5C.

FOR ATLAS • LOGAN • SOUTH BEND • CRAFTSMAN • SHELDON LATHES, ETC.

LEVER-TYPE DRAWBAR ½" cap.

Positive grip on undersize, oversize or standard diameter work. Patented coordinate cams eliminate fingers.

LIVE CENTER (Ball Bearing). Double sealed for accuracy.

HAND DRAWBAR ½" cap.

Let us quote on your quantity orders for any types of collets, live center or other machine tool attachments!

IMMEDIATE DELIVERY FROM STOCK

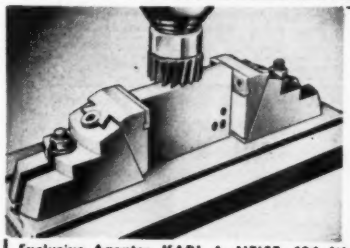
KASSON Precision PRODUCTS

Guaranteed unconditionally. Distributers inquiries invited.

WRITE FOR FREE LITERATURE!

KASSON DIE AND MOTOR CORP.
32-14 Northern Blvd. • L. I. City 1, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 1931



MASTER GRIPPING CLAWS
System Hubner

WHY use them?

1. Clamping action Vertical as well as Horizontal—pressing workpiece down directly on the machine table. No hammering and still no air between.
2. Gain more working room.
3. Faster and more secure setups. Easier to handle.
4. Unlimited jaw opening.
5. No straps overlapping on the workpiece; more machining surface.
6. Extremely versatile—take light cuts or heavy cuts, use on small machines or heaviest production machines.

Exclusive Agents: KARL A. NEISE, 404 4th Ave., N. Y. 16, N. Y., Dept. TP

NEISE MODERN TOOLS

CIRCLE INFORM-A-GRAM KEY NO. 1932

Save Taps—Save Time—Cut Costs

Multi-Fluted Self-Tapping Set Screws

Additional cutting edges make tapping easier and produce better thread. For metal or plastics applications. Not only self-tapping, but self-aligning and self-locking. Complete size range including smaller sizes. With standard thread, this screw can be used in paint-filled tap holes as a clean-out or reaming screw, yet remaining in hole as a standard screw.

Slotted, Fluted or Hexagon Type

Pat. Pend

—with any of these points

Fill in and mail coupon at the right for further data on this and other special Set Screws.

Set Screw & Mfg. Co.
158 Main St., Bartlett, Ill. (Chicago Suburb)
1805TP

We Specialize in Solving Puzzling Set Screw Problems

COUPON

SET SCREW & MFG. CO., 158 Main Street, Bartlett, Illinois

Without cost or obligation please send me data on

☐ Multi-Fluted Self-Tapping Set Screws ☐ Other Setko Set Screws

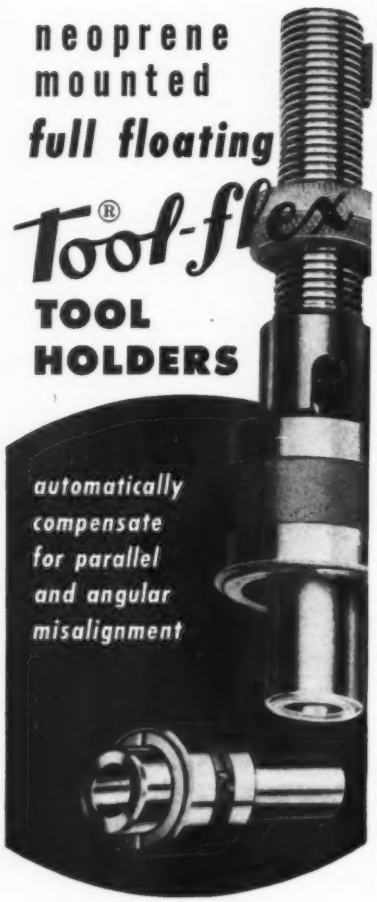
INDIV. NAME .....

COMPANY .....

ADDRESS ..... CITY ..... ZONE ..... STATE .....

CIRCLE INFORM-A-GRAM KEY NO. 1933

neoprene mounted full floating Tool-flex® TOOL HOLDERS



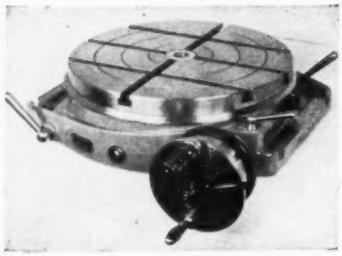
The oil, heat and wear resistant Neoprene insert, found only in "Tool-flex", provides a universal float that corrects for both parallel and angular misalignment. This assures quick set-ups and minimizes scrap due to bell mouthed and oversized holes or torn and oversized threads. By floating reamers, taps, etc., in a cushion of Neoprene, tool life is increased. Available in a range of sizes and models to suit any requirements, including close centers and Acme threaded shank for multiple spindle set-ups. "Tool-flex" holders are fully guaranteed.

Write Dept. TP-11 for information

BURG TOOL
MANUFACTURING COMPANY, INC.
15001 SO. FIGUEROA STREET
GARDENA, CALIFORNIA

CIRCLE INFORM-A-GRAM KEY NO. 1941

WALTER



PRECISION DIVIDING ROTARY TABLES
With and Without Dividing Discs

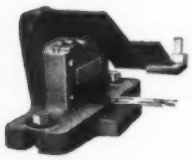
- READABILITY: 6 SECONDS.
- CONSTRUCTED FOR LONG LIFE.
- MAINTAIN PRECISION.
- AVAILABLE IN 10", 12½", 15¾", 19¾", 25", 31".

Also many types of Universal Precision Dividing Heads and Attachments for most economical production.

Test reports furnished with literature.

Sole Agents for U.S.A.
KARL A. NEISE
404 FOURTH AVE., DEPT. TP
NEW YORK 16, N. Y.
NEISE MODERN TOOLS

CIRCLE INFORM-A-GRAM KEY NO. 1942



New Low Cost
AUTOMATIC SCRAP CHOPPER
3" wide $69.00
6" wide $95.00
12" wide $195.00
Write for details

JACO DEVICES, INC.
96 High St., Hingham, Mass.

CIRCLE INFORM-A-GRAM KEY NO. 1943

Executive head of large plastics firm

"My firm saves $27,000 annually with specially designed ESSEX carbide burrs."

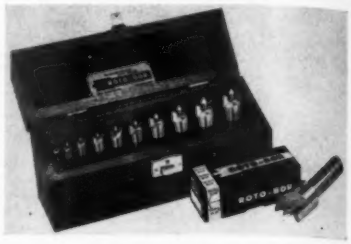
"Before we switched to ESSEX tools, we spent $45,000 yearly for high speed burrs. ESSEX carbide burrs, made to our specific needs, cost us only $18,000 — an annual saving of $27,000!"

Find out how ESSEX carbide tools can help *you*. Write for *free*, 12-page illustrated catalog today.

ESSEX ROTARY FILE & TOOL CORP.
295 MADISON AVE, N. Y. C 17, T&P-116
My name.....
Company.....
Address.....
City..... Zone..... State.....

CIRCLE INFORM-A-GRAM KEY NO. 1944

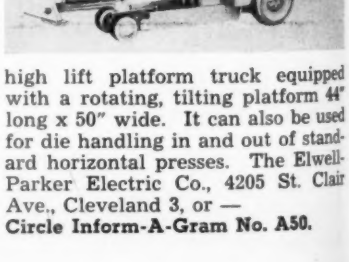
Drill Extremely Light Gauge Metals and fiber boards accurately and without distortion of the material with the Roto-Bor. The tool is available in 54 stock sizes. It will also drill some materials up to ¼". The Roto-Bor cuts an accurate, almost



burr-free hole in sheet aluminum, steel, brass, copper, hard rubber, rigid plastics and hardboards. It operates in portable or stand drills at twist drill speeds. Jancy Engineering Co., 508 S. Pine St., Davenport, Iowa, or —
Circle Inform-A-Gram No. A48.

A Neoprene "O" Ring Seal is now incorporated into the collets produced by Balas Collet Mfg. Co., Cleveland 14. This seal is designed to keep dirt out of the aperture between the collet draw tube and spindle. It also prevents chips and dirt from working back into the chucking mechanism. Machines equipped with the collets having the Neoprene "O" ring seal are reported to operate for over a year without having to clean the spindles and draw tubes. For further information on the collets, contact the company, or —
Circle Inform-A-Gram No. A49.

Designed for Handling Dies onto medium to large size inclined presses is this die handling truck with a capacity of 5,000 lbs. It permits changing dies more rapidly, reducing press down-time. The die handler is built on the chassis of an electric powered



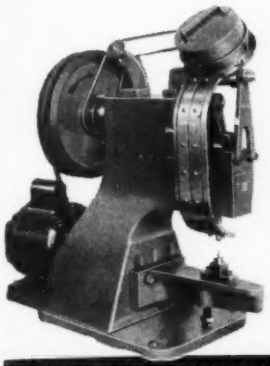
high lift platform truck equipped with a rotating, tilting platform 44" long x 50" wide. It can also be used for die handling in and out of standard horizontal presses. The Elwell-Parker Electric Co., 4205 St. Clair Ave., Cleveland 3, or —
Circle Inform-A-Gram No. A50.

Have you looked at your permanent fastenings lately?

EYELETS can be the key to product improvement and continuing savings!

Edward Segal

AUTOMATIC EYELETING MACHINERY



Many fastening jobs can be eyeleted at considerable savings over other methods.

Eyelets usually cost less, and with positive-acting Edward Segal automatic machinery, feeding is simplified. With dependable Segal machines you can get the adjustable travel spindle (Pat Pend.) which permits settings even as tiny as .032" I.D., without fear of costly tool breakage.

Segal engineers will gladly discuss your fastening problem and tell you quickly whether eyeleting is the solution Write today – and also ask for our brochure loaded with eyelet setting data.

EDWARD SEGAL • 72 SPRING STREET, NEW YORK 12, N. Y.
Eyeleting machinery, special hoppers & feeding devices

CIRCLE INFORM-A-GRAM KEY NO. 1951

METAL PRODUCTION CAPACITY AVAILABLE

For long or short production runs of large or small parts, tools, jigs or fixtures. Also dies, gages, special machinery.

KELLER PROFILOMETER-DUPLICATOR, 16" x 24"
PRESSES UP TO 450-TON, 48" x 48", TRIPLE ACTION
PLANERS UP TO 20-FOOT STROKE, 72" x 72"
RADIAL DRILL PRESSES UP TO 8-FOOT, 19" COLUMN
LATHES UP TO 158" c.c., 57½" gap, 40" SWING
BORING MILLS UP TO 120" BED, 90" HORIZ., 60" VERT.

Also Milling Machines, Grinders, etc. Complete production facilities — experienced machinists.

Eliminate Your Problems—Complete Design-and-Build Service

Inquiries Invited on Contract Basis or Individual Quotation

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NORTH TONAWANDA, N. Y. Phone JA. 1200

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Expanding Mandrels

Accuracy 001" - No Distortion
No Slipping - Everlasting

K.O.LEE CO.
ABERDEEN, SOUTH DAKOTA

If it's made by Lee *it's a* "Knock-Out"

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Drill Hardened Steels without Annealing –

With the new, improved "HARDSTEEL" Drill, you can do accurate, smooth drilling, countersinking, counterboring and reaming in steels hardened by any process without first annealing the work. And they work with equal ease on work-hardening steels and high carbon–high chrome steels of any degree of hardness.

"HARDSTEEL" Drills fit standard drill presses. They save time and reduce rejects. They permit engineering changes requiring additional drilling after hardening. And parts drilled after hardening always match at assembly.

Write for a copy of the "HARDSTEEL" Operators Manual showing how "HARDSTEEL" drills are cutting costs in thousands of plants.

You Harden It—We'll Drill It—
With "HARDSTEEL"

BLACK DRILL COMPANY, INC.
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"HARDSTEEL"

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TO 200,000 PARTS PER HOUR

NOW AVAILABLE FOR THE FIRST TIME is a completely standardized, versatile, high speed hopper, quickly adjustable for size, shape and count.

ONLY 5 MINUTES CHANGE-OVER TIME
WRITE FOR DETAILS

U.S. ENGINEERING COMPANY
40-24 22nd St., Long Island City 1, N.Y. Phone: STillwell 6-7848

CIRCLE INFORM-A-GRAM KEY NO. 1955

REID TOOL ROOM Accessories

BALL HANDLES — Threaded

ROUND PLASTIC

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ROUND STEEL

Designed for machine tools, jigs, fixtures, shift lever handles etc. and give your product that "dressed-up" appearance. Made in a wide variety of diameters and thread sizes. Round and oval plastic available in red and black. Steel ball handles are turned from bar stock. Highly polished. Low prices and the finest quality.

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CIRCLE INFORM-A-GRAM KEY NO. 1961

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MICROFLAT®

BLACK GRANITE

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- ANGLE PLATES
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COLLINS MICROFLAT surface plates and precision accessories offer the user life-time accuracy at a minimum cost

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COLLINS MICROFLAT COMPANY, INC.

2326 E. 8th St. Los Angeles 21, Calif.

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HARDENED and GROUND HSS BLANKS

Any decimal diameter — any length. Mirror finish surface to gage tolerance.

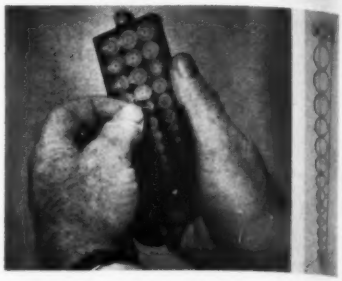
Many uses — —core pins, punches, gages, ejector pins, insert pins, special tools, etc. — Quick delivery.

Write or phone DRexell 6-4223 for price list D-3

WILLIAM T. HUTCHINSON CO.
53 Brown Ave., Springfield N. J.

CIRCLE INFORM-A-GRAM KEY NO. 1963

Sizing and Gaging are performed by precision micro-balls available in a carrying case. The balls range in size from 1/16" to ½" dia and are made to a 0.000025" tolerance. There



are 15 sizes, three balls of each size. The sizes of the balls are listed on the back of the case in fractions and decimals. F. & M. Sales Co., 2928 Fisk Lane, Redondo Beach, Calif., or — **Circle Inform-A-Gram No. A51.**

A Fire-Resistance Hydraulic Fluid has been developed by E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33. Houghto-Safe 1020 is designed for systems operating at temperatures above 150°F and for heavily loaded pumps and bearings. It features greater film strength and lubricity, and in addition, is fortified with rust preventives and antifoaming agents. For further information, contact the company, or — **Circle Inform-A-Gram No. A52.**

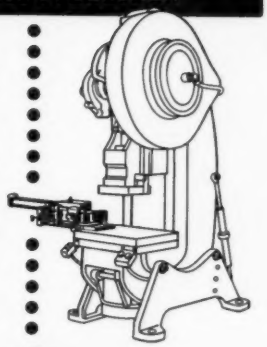
A Wide Variety of Deep Hole Drilling Operations can be performed with standard stock 12" and 16" Longboy Drills. They are available in fractional sizes ranging from

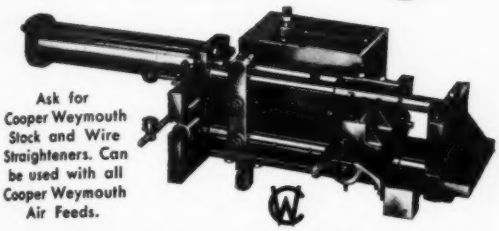
3/16" to ¾". Their construction features assure an equally distributed cutting load, smooth chip flow and a reduced resharpening frequency. Ace Drill Corp., Adrian, Mich., or — **Inform-A-Gram No. A53.**

Thorough Cleaning Ability is combined with safety factors in Composition 117, a solvent detergent. It is designed to remove grease, oil and smut from machinery where water cannot be used. Composition 117 is used full strength applied by brush, immersion or a non-atomizing spray. No rinse is necessary since parts can be blown dry with compressed air. Oakite Products, Inc., 157 Rector St., New York 6, or — **Circle Inform-A-Gram No. A54.**

COOPER WEYMOUTH
AIR OPERATED SLIDE FEEDS
Boost Power Press Production

Specifically designed to solve the automatic feeding problems in press rooms. Simplified, open throat construction. Air operated from standard shop lines. Easily set up and adjusted at the front, rear or sides of press for accurate long or short runs. Cooper Weymouth Air Feeds, made in five sizes, will feed lengths up to 36", of stock up to 18" in width. They are readily adaptable to material of irregular cross section and ideal for use with hydraulic presses.





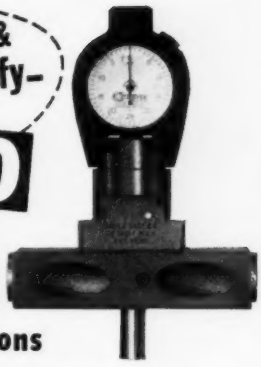
Ask for Cooper Weymouth Stock and Wire Straighteners. Can be used with all Cooper Weymouth Air Feeds.

SEND FOR INFORMATION ON THESE AND OTHER PRODUCTS

COOPER WEYMOUTH, INC.
600 HONEYSPOT ROAD, STRATFORD, CONN.

CIRCLE INFORM-A-GRAM KEY NO. 1971

more designers & tool builders specify–
HANLO
UNIVERSAL GAGE UNITS
for these 7 reasons



1. All parts of Hanlo Units are standard and replaceable.
2. All moving parts are fully enclosed, and well protected from dust and foreign matter.
3. Any impact from external or internal shock, is absorbed by the gage unit, and not the indicator.
4. The indicator is fully protected on all sides.
5. Indicator movement is restricted within one revolution, to insure against both injury and misreading.
6. Indicator can be rotated in movements of 45°, to permit easy reading on large gages, or in cramped areas.
7. Hanlo Units are never obsoleted by model or engineering changes—simply transfer the standard units.

TRACING TEMPLATES ARE AVAILABLE ON REQUEST

HANLO GAGE COMPANY
division of
JOHNSON DIE AND ENGINEERING CO.
16150 Hubbell Ave. ▪ Detroit 35, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 1973

NOW
FROM THIS CATALOG

NEW CARBIDE TOOLING PRECISION-MADE

Golden-Circle Rotary Tools

New! Elgin's expanded line of burs and rotary files, plus solid carbide end mills, all shapes and sizes precision-made. See how they can meet your requirements at lower cost! Write for your FREE copy of the new "Golden Circle" booklet today!

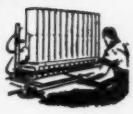
ABRASIVE DIVISION, DEPT. D
ELGIN NATIONAL WATCH COMPANY
Elgin, Illinois

CIRCLE INFORM-A-GRAM KEY NO. 1972

THE LOW COST *Impact* AIR HAMMER

CUTS COSTS AMAZINGLY IN

- ASSEMBLING
- EMBOSSING
- FORMING
- PUNCHING
- BLANKING
- COINING
- PEENING
- RIVETING
- CRIMPING
- CUTTING
- FORGING
- MARKING



Most jobs done on expensive, heavy presses can *now* be done faster and cheaper by the light low-priced Mead Air Hammer using the new adjustable, spring*less* "Bullet Velocity" MEAD AIR TRIP! It delivers blows equivalent to 7½ tons down to as little as a few ounces—at several blows per second, if desired! Enjoy the *competitive benefits* of really low cost production with durable, powerful, improved Impact Air Hammer. Put Mead "how-to-do-it" experience to work for you.

Write Factory Now For Nearest Mead Man Name and Cost-Cutting Bulletin No. HA-116

MEAD
MEAD SPECIALTIES COMPANY
4114 N. Knox Ave., Dept. HA-116, Chicago 41, Illinois

Pathfinder in AIR POWER AUTOMATION

CIRCLE INFORM-A-GRAM KEY NO. 1974

Sperry
ultrasonic inspection news

40-Foot Aluminum Extrusions Inspected Under Water

How to inspect 40-foot, 1850-lb. aluminum extrusions for internal defects prior to machining into helicopter blades?—Piasecki Helicopter Corp., Morton, Pa., required an immediate answer to this problem.

The solution was provided by Sperry Products' Commercial Testing Service. At Sperry's Danbury laboratory personnel and equipment were available, including a 100-foot tank which would permit ultrasonic immersion inspection of the huge extrusions.

Actual inspection was done with a Sperry UW Reflectoscope and a PH Positioner. Mounted on an electric car which also carried the operator, this unit was capable of testing at speeds ranging from 2 feet to 32 feet per minute.

To best meet your individual inspection requirements, consult Sperry Products Commercial Testing Service. Return coupon for full information.

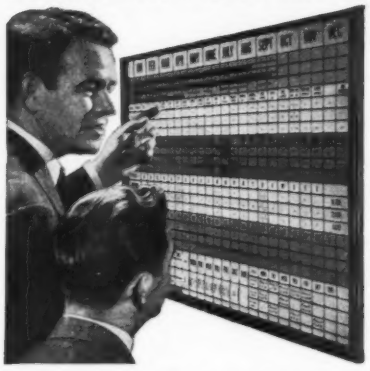
sperry products INC.
Danbury, Connecticut

☐ Send me Commercial Testing Service information.
☐ Send me the Ultrasonic News Letter.
☐ Send me Reflectoscope information.

Name_____
Title_____
Company_____
Address_____
City_____ Zone____ State_____

CIRCLE INFORM-A-GRAM KEY NO. 1981

You Get Things Done With Boardmaster Visual Control



☆ Gives Graphic Picture of Your Operations—Spotlighted by Color
☆ Facts at a glance — Saves Time, Saves Money, Prevents Errors
☆ Simple to operate — Type or Write on Cards, Snap in Grooves
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Complete price $49.50 including cards

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Without Obligation
Write for Your Copy Today

GRAPHIC SYSTEMS
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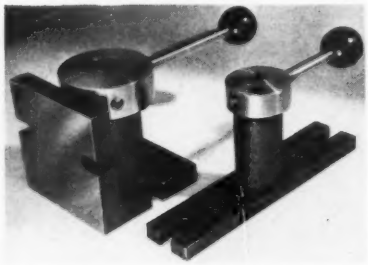


A Precision Production Holding Device

For drilling, tapping, milling, threading, reaming, etc., holding finished parts. Helpful on sub-assembly. Universally adaptable to drill presses, milling machines, surface grinders, tapping machines, etc. In 6 models, using 3C, 1A, 5C and 3AT Collets—capacity to 1", depending on Model. Price $29.50 to $62.50. Write for further information and name of Tool Supplier. Territories open for Suppliers.

ARROW MACHINISTS
17 NORTH WEST STREET • MOUNT VERNON, NEW YORK

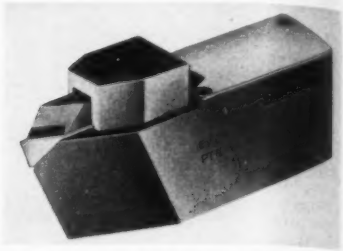
CIRCLE INFORM-A-GRAM KEY NO. 1983

Low Cost Automatic
HORIZONTAL STOCK REEL
Self-powered
24" dia. $85.00
30" $90.00
36" $95.00
Write for details

JACO DEVICES, INC.
96 High St., Hingham, Mass.

CIRCLE INFORM-A-GRAM KEY NO. 1984

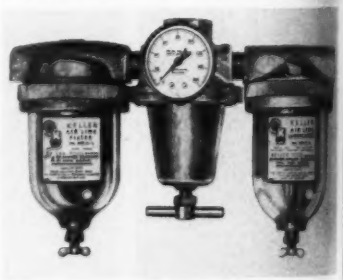
A +GF+ Copying Lathe Carbide Toolholder has been developed by Everede Tool Co., 2000 N. Parkside Ave., Chicago. It is reported to reduce tool costs 66% while performing



on all type of steels with different finishings and cutting problems. The holder can plunge machine ½" deep at 30° and on the same part face out on a flange in one operation. It features neutral or positive rake, and any nose radius or lead angle.
Circle Inform-A-Gram No. A55.

Grind Long Surfaces with a special heavy duty grinding machine developed by Morton Mfg. Co., Broadway and Hoyt, Muskegon Heights, Mich. It can grind either straight surfaces or long curved irregular surfaces to template. The drive provides varying speeds up to 100 fpm. The compound saddle provides a means whereby the grinding column, on which the vertically movable spindle is mounted, can be moved toward or away from the work a distance of 24".
Circle Inform-A-Gram No. A56.

This Air Line Filter-Regulator-Lubricator drains from the bottom without removing the bowl. The pressure regulator operates in an inverted position to permit a more

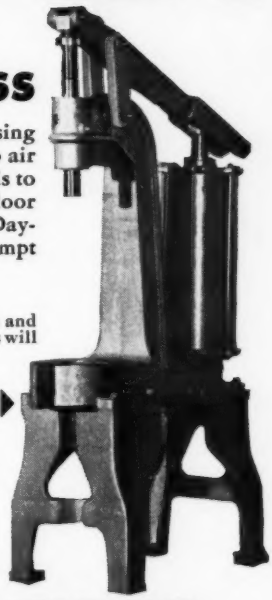


compact installation that can be designed into any air-powered equipment. The filter-regulator-lubricator is available in any combination or as individual units for ⅜", ½" or ¾" compressed air line. Keller Tool Div'n, Gardner-Denver Co., Grand Haven, Mich., or —
Circle Inform-A-Gram No. A57.

SAVE!

WITH A HANNIFIN AIR PRESS

It's the ideal press for that occasional pressing job. These presses operate off ordinary shop air supply. They're fast and safe. Over 30 models to choose from...many for either bench or floor mounting. Capacities from ½ to 18 tons. Daylight to 46 inches...reach to 12 inches. Prompt delivery.



WRITE. Complete information and prices on Hannifin Air Presses will be sent on request.

6 Tons (Model B-2) One of more than 30 models. Press with base, $519.

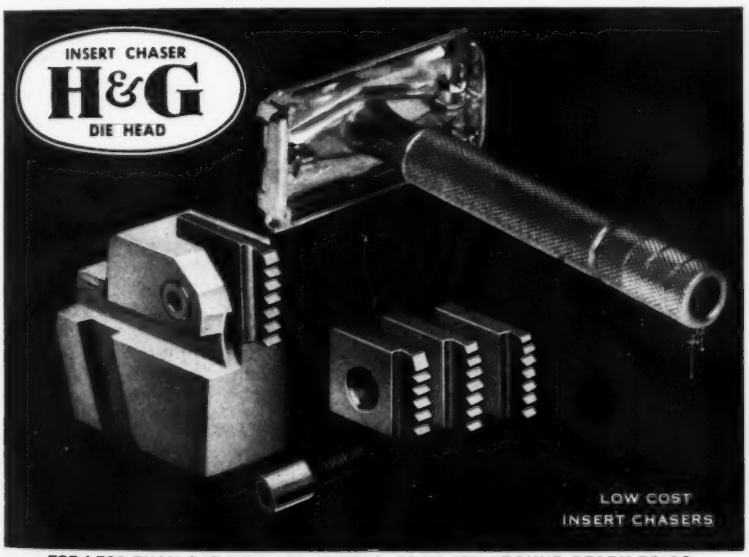
1-ton Hand-D-Press. For small parts manufacturers. Press only, without valves, $232.

Prices F.O.B. our press plant, St. Marys, Ohio, subject to change without notice.

HANNIFIN

HANNIFIN CORPORATION, 563 S. WOLF ROAD, DES PLAINES, ILLINOIS

CIRCLE INFORM-A-GRAM KEY NO. 1991



FOR LESS THAN $45 YOU GET 12 SETS. EACH SET GROUND READY TO GO

Men would not accept either idea at first...

INSERT CHASERS SAVE UP TO 33%

Insert chasers are like safety razor blades: they cost so little that you can throw them away when dull. Or, for utmost economy, you can resharpen them over and over again. Only a flash grind is required. For less than $45 you get a dozen sets of ¾—16 insert chasers, each set ground ready to go. You will be amazed at the quantity of threads they will cut, even to Class 3 specifications, with a minimum of downtime. FREE: "UNIFIED AND AMERICAN SCREW THREAD DIGEST"

THE EASTERN MACHINE SCREW CORPORATION 29-49 Barclay St., New Haven, Conn.

CIRCLE INFORM-A-GRAM KEY NO. 1992

Long length drills for general purpose drilling!

ACE

TAPER LENGTH DRILLS

Feature for feature, you can't beat Ace Taper Length Drills. First, because they're made of the finest quality high speed steel properly heat treated to assure the ultimate in uniform hardness. Second, because they're produced by the Ace-originated "ground-from-the-solid" process to give them smoother, more highly polished flutes with keener, stronger cutting edges. And finally, because they cut faster, last longer, give you more production per drill at lower cost.

Call your local Ace Drill Distributor today!

NEW CATALOG covers the entire line of Ace "Ground-from-the-Solid" High Speed Steel and Carbide Drills, Reamers, Drill Blanks and Special Drills. Send for it today!

ACE DRILL

ADRIAN, MICHIGAN

ORIGINATORS OF "GROUND-FROM-THE-SOLID" DRILLS

CIRCLE INFORM-A-GRAM KEY NO. 1993

Here's **FREE** help in solving thousands of difficult

PRODUCTION AND INSPECTION PROBLEMS

24 pages packed with guidance on the selection and specific on-the-job applications of all types of Industrial Magnifiers.

This practical booklet answers all your questions: "Just what is a magnifier?", "Why so many different KINDS of magnifiers?", "What is meant by a 'corrected' lens?" It also discusses correct working distances, magnification and field of view, magnifiers as precision instruments, and how to hold a magnifier. All this—PLUS condensed catalog listings giving specifications and suggested uses of available types of magnifiers which will cut rejects, save money and speed production!

Send for your FREE copy today! Bausch & Lomb Optical Co., 50411 Bausch St., Rochester 2, N. Y.

BAUSCH & LOMB

Industrial Magnifiers

CIRCLE INFORM-A-GRAM KEY NO. 2001

"Raymac"

SOLID CARBIDE ROTARY FILES

Give Up to 25% Longer Life

"Raymac" solid carbide rotary files are hand cut, lapped, held to close tolerances and manufactured from Dexco's select carbide stock. This gives you a solid carbide rotary file with longer life, no center dead spots and perfect balance at high speeds.

"Raymac" gives you a complete line of standard carbide rotary files. For your special jobs, Dexco's skilled craftsmen will custom build Raymac solid carbide rotary files to your own specifications. It's "Raymac" for the finest in solid carbide cutting tools. Write or call us today.

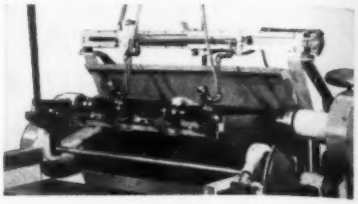
"Raymac" Division DEXCO CORPORATION

15490 Dale Avenue • Detroit 23, Michigan

Telephone KEnwood 5-9440

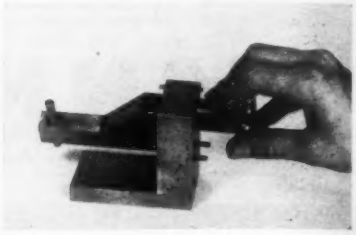
CIRCLE INFORM-A-GRAM KEY NO. 2002

Adjustable Coverage from 2" to 40" is a feature of this automatic liquid abrasive spray gun mover. No. 3020 gun mover can be equipped with either one or two spray guns and will accommodate either two or



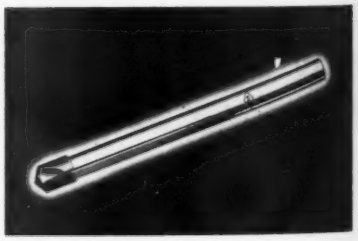
three-port guns. Straight line traverse is adjustable over an unlimited range of uniform speeds. The gun mover is adjustable for spray in either one or both directions of traverse. Clair Mfg. Co., Inc., Olean, N. Y., or — **Circle No. A58.**

Accurate to 0.0002" is the "JR" radius dresser. Designed for bench surface grinders, it shapes and dresses grinding wheel radii, either concave or convex or combinations



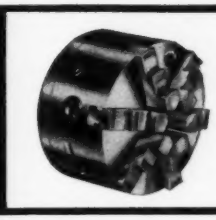
of both. Any thickness wheel can be dressed, up to and including ½" thick. Stop pins allow complete adjustment from 90° through 180°. Somerset Tool Co., Virginia St., Hillside, N. J., or —
Circle Inform-A-Gram No. A59.

Designed for Drilling Hardened Die Steel are carbide die drills. These drills permit hardened parts to be economically salvaged without annealing, reworking or reharden-ing. They can also be used for cutting through hard outer cases or for



drilling intricate parts. The drills manufactured by Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich., are available in sizes 1/16" to ¾" and in sets.
Circle Inform-A-Gram No. A60.

compare HORTON Tru-Set FEATURES



- Repetitive accuracy to .0002" T.I.R. guaranteed
- Rugged Meehanite bodies guaranteed for life
- Instant peripheral location – 3 operating pinions
- Available up to 12" in both 3 and 6 jaw styles
- Packed in reuseable airtight metal containers

compare HORTON Tru-Set PRICES

SIZE	MODEL	NET PRICE
5	5T6	86.35
6	6T6	120.65
8	8T6	167.65
10	10T6	247.65
12	12T6	298.45

Chucks listed above are 6 jaw universal type with two sets of jaws. See your Horton Distributor or write direct for new Net Price Selector

HORTON CHUCK

HORTON CHUCK
WINDSOR LOCKS, CONN.

CIRCLE INFORM-A-GRAM KEY NO. 2011

WORLD'S HARDEST METAL

● New, improved TALIDE METAL is uniform in quality—gives top performance on ALL cutting, drawing and wear-resistant applications. Write for Catalog 56-G. METAL CARBIDES CORP., Youngstown 12, Ohio.

CIRCLE INFORM-A-GRAM KEY NO. 2013

THE GAGE USED BY:

USERS INCLUDE:
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Allison Div.
Apex Electrical Mfg.
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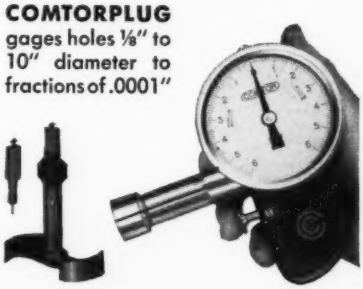
Chicago Pneu. Tool
Chrysler Corp.
Continental Motors
Curtiss-Wright
Detroit Transmission
Douglas Aircraft
Fairchild Engine & Airplane Co.
Falk Corp.
Ford Motor Co.
General Electric Co.
Hamilton Standard Division
Harris Seybold Co.
Homelite Corp.
Int. Harvester Co.
Jacobs Mfg. Co.
Lycoming-Spencer Div.
McDonnell Aircraft
Northrop Aircraft
Otis Elevator
Pontiac Motor Div.
Scintilla Magneto
Steel Products Eng.
Studebaker-Packard
United Airlines
Warner Gear Div.

This is it

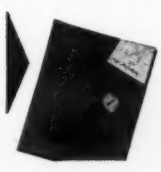
COMTORPLUG gages holes ⅛" to 10" diameter to fractions of .0001"



Maybe you, too, have a volume gaging problem it could solve.

Send for Bulletin and see

ASK FOR BULLETIN 49

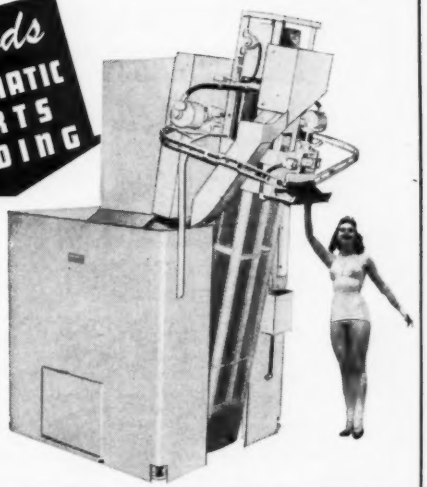


COMTOR COMPANY
82 Farwell St., Waltham 54, Mass.

CIRCLE INFORM-A-GRAM KEY NO. 2012

WORLD'S LARGEST HOPPER

Speeds AUTOMATIC PARTS FEEDING



Think of it! With a *45 Cu. Ft. Hopper* FEEDALL Model 2500B elevates parts and feeds them thru multiple chutes to assembly lines or production machines. Huge hopper saves storage space — prevents floor cluttering.

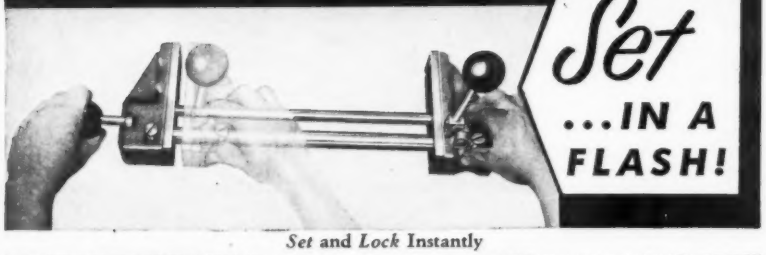
Work Range: Rolling Parts 5" in dia.; 3/16" to 1½" long. Sliding Parts 3/16" to 2" in dia.; 6" long.

Complete Specifications on request. In writing advise purposes for which automatic feeds are required.

FEEDALL INCORPORATED WILLOUGHBY, OHIO

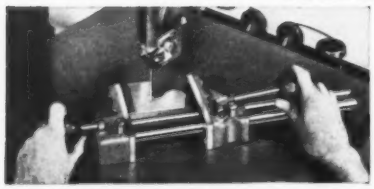
CIRCLE INFORM-A-GRAM KEY NO. 2014

NEW HEINRICH WORK HOLDERS

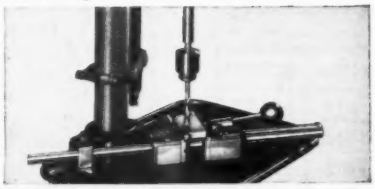


Set ...IN A FLASH!

Set and *Lock* Instantly



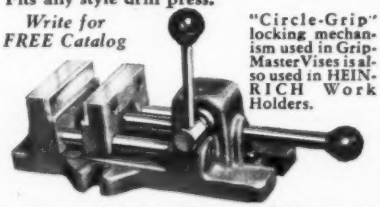
Heinrich Band Saw Vise. Capacity, 12½". Hands are clear for *safe* operation.



Heinrich Safety Drill Vise. Capacity, 6". Fits any style drill press.

New HEINRICH Grip-Master Work Holders set and lock instantly. Band Saw Vise has removable shoulder screws for automatic chain feed operation. Safety Drill Vise with table mounting attachment leaves operator's hands free . . . safely secures vise . . . eliminates danger of unit spinning or breaking loose.

Write for FREE Catalog

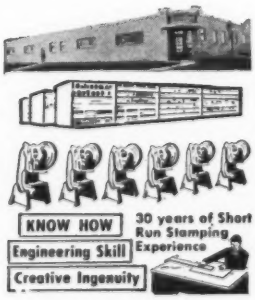


"Circle-Grip" locking mechanism used in Grip-Master Vises is also used in HEINRICH Work Holders.

HEINRICH TOOLS, Inc., Dept. 136-L Racine, Wisconsin

CIRCLE INFORM-A-GRAM KEY NO. 2021

How Federal's **A.Q.*** SHORT RUN STAMPING SERVICE *saves YOU time and money . . .*



1. You send us your print, sketch or sample. It undergoes a complete analysis from the standpoint of materials, men, methods, machines and delivery. An analyzed quotation is promptly submitted without obligation to you.
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3. Stampings are fabricated in our modern press department.
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Be sure your next short run stampings are produced accurately, economically and quickly—send your print, sketch or sample for our . . .

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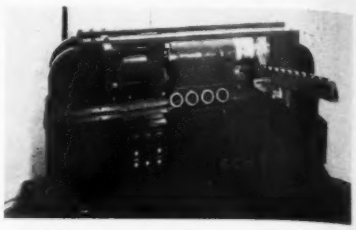
Federal TOOL & MFG. CO.

Quality Stampings in Small Quantities

3614 Alabama Ave., Minneapolis 16, Minn.

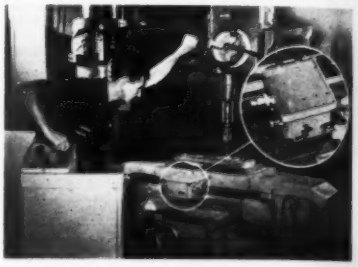
CIRCLE INFORM-A-GRAM KEY NO. 2022

Mark the Face of Bearing Races in production with Model 385 hydraulic bearing marking machine. It will accommodate bearings from 15/16" to 3⅞" dia and thicknesses of ½" to 1⅜". A variable drive provides



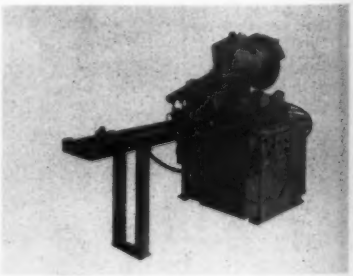
marking capacity from 1250 to 1680 bearings/hr. Geo. T. Schmidt, Inc., 4112 Ravenswood Ave., Chicago 13, or—**Circle Inform-A-Gram No. A61.**

An Improved Indenter Mechanism for the Micro-Positioner automatic indexing table has been announced by Micro-Positioner Corp., 716 Wilshire Blvd., Santa Monica, Calif. The



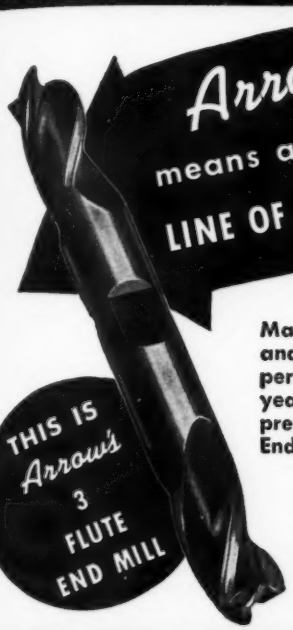
improvements include micro control knobs and locks which allow complete adjustment of the indentation sensing and tape relocating and an indenter safety switch.
Circle Inform-A-Gram No. A62.

The M-75 Cut-Off Machine designed for cutting ferrous metals, is now equipped for automatic production work. Speeds of 550 cuts/hr are maintained during production runs, with tolerances held to less



than 0.005". Work is turned out with a milled-like finish, eliminating need for further machining. The machine will cut 1½" solid rounds with ease. Stone Machinery Co., Manlius, N. Y., or—**Circle Inform-A-Gram No. A63.**

ARROW TOOL & REAMER CO. • Established 1916



Manufacturing skill and tool making experience for over 37 years — adds up to preference for Arrow End Mills.

ARROW TOOL & REAMER CO.
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500 lb. Lifter-
NOW $210 f. o. b. Chicago

Pays for itself over and over again in time saved and by avoiding lifting injuries in moving dies, machine parts and stacking. Can be used as adjustable height work table. Rugged, simple construction, with few moving parts, has high safety overload factor. Automatic clutch holds load at any height.

Specifications: platform 24" x 24", lifting height 4' 6". Overall height 6' 0". Width 24". Foot operated floor lock.

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WE WILL MAKE
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COMPLETELY AUTOMATIC

Now . . . any part being ground on a centerless grinder can be fixtured to be AUTOMATICALLY FED into the machine and ground to size, shape or form . . . with the grinding process continuously under gauging control.

FIND OUT THE
HOW'S AND WHY'S OF IT

Send us a part print, type and serial number of your machine. We'll send a quote and information.

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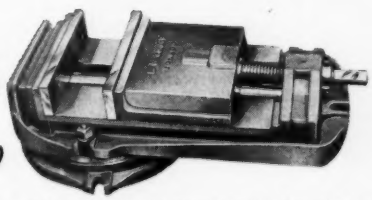
Never Before Such a Super-Strong, Super-Accurate
Flange Construction Milling Machine Vise
At Such a Low Price!

The New
L-W MOGUL
8" Swivel Base
VISE
Only $180.00



- Steel jaws 5/8" thick, 8 5/8" wide and 2-3/16" deep open 6 inches when in place.
- All surfaces ground for extreme accuracy.
- Full length bearing on ground bar and machined ways.
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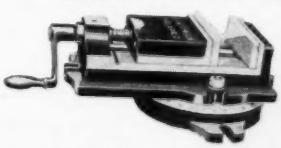

Master size. Jaws 6½" x 2". Opens 5¼" without jaws, 4" with jaws. Wt. 90 lbs. $82.00

Junior size. Jaws 4½" x 1¾". Opens 3½" without jaws, 3" with jaws. Wt. 40 lbs. $56.00

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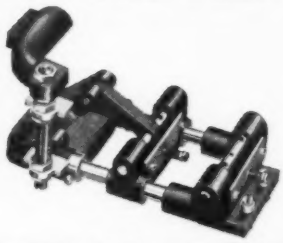
CIRCLE INFORM-A-GRAM KEY NO. 2041

A SURE FEED



PRODUCTO AUTOMATIC "SUREFEED"

Your pressroom can produce more with this compact, durable stock feed. Can be mounted right on die set to save you time. Direct linkage feeding affords greater accuracy. Comes in 2" and 3" sizes. Write for detailed bulletin on this cost-cutter.

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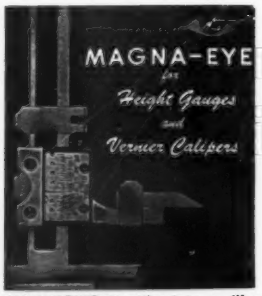

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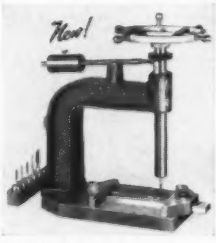
MAGNIFIES the "hard to read" vernier scales on calipers and height gages. No more eye strain, guess work or hit or miss setting and reading. **LENS** is finest quality optical glass, specially designed and ground for the purpose with utmost optical skill 4X magnification shows lines true and correct. In daily use in plants of Westinghouse, General Electric, General Motors, Chrysler, Packard, Ford, Boeing Aircraft, Bendix Aviation and many others engaged in defense work.
Made in 3 sizes to fit Starrett, Brown & Sharpe, Lufkin Tools, and others of similar design. S No. 100 for 6" Vernier Calipers; S No. 200 for 10"-12" Height Gages, also 10"-18"-24" Vernier Calipers; S No. 300 for most popular type 18" and 24" Height Gages and for 36"-48" 60" and 72" Calipers.
For Complete Information Write, Phone or Wire

STEBAR COMPANY
215-221 28th Ave. North Minneapolis 11, Minn.

CIRCLE INFORM-A-GRAM KEY NO. 2043



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SUPERSENSITIVE HAND TAPPER

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Engineering Products
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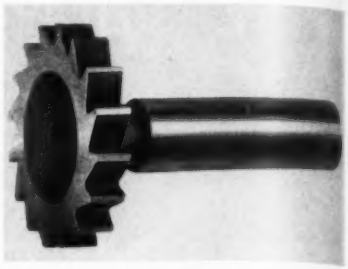
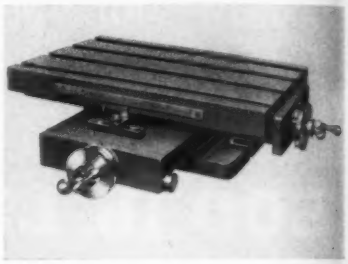
A Complete Line of Woodruff Keyseat Cutters has been announced by Fastcut Tool Co., 7405 E. Davison, Detroit 12. These cutters feature a 5° positive rake angle to assure fast,



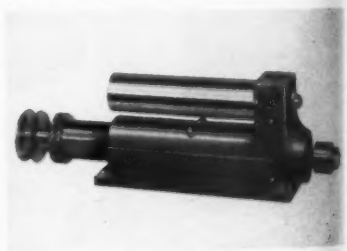
accurate cutting. They are available in 41 stock sizes covering American Standard numbers 202 through 1212. The cutters are all right-hand with a ½" shank.
Circle Inform-A-Gram No. A64.

This Cross-Slide Table fits on all rotary tables 12" or more for radii and angle milling on all vertical milling machines. Its table top is 8" x 12" and has four t-slots with 6" scales on each slide. The cross-slide table is



adaptable for all work on mold cavities and plungers, dies and templates. For further details, obtain literature from Lawrence H. Cook, Inc., Massasoit Ave., E. Providence, R. I., or — **Inform-A-Gram No. A65.**

This Floating Spindle Drill Unit is used for drilling, reaming, countersinking and other machine operations where other setups may not be practicable and where hydraulic



feed and accurately controlled speed rates are not essential. It is equipped with a ¼" capacity Jacobs chuck selected for accuracy. Burklyn Co., 3429 Glendale Blvd., Los Angeles 39, or — **Inform-A-Gram No. A66.**

For VERSATILITY IN THE SHOP — ON THE JOB

cut it with the **WELLS 49-A**

Here's real versatility in a Metal Cutting Bandsaw. The Wells 49-A is a dual purpose machine designed for shop or "job-site" work—economical to buy—economical to operate. Has 3" pipe capacity.

Use it as a horizontal cut-off saw to handle conduit cutting, bar stock or odd shapes. Swing the head into vertical position and the 49-A converts to an upright bandsaw for cutting angles, slots, notches, bevels and contour work.

The ½" blade is powered by a ¼ H.P. motor—other features include three selective speeds, positive vise action and automatic shut-off after each cut.

Ask your Wells Distributor for full information or write direct.

As a Vertical Bandsaw

For Horizontal Cut-off

Wells

The Pioneers of Horizontal

METAL CUTTING BAND SAWS

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Have you seen what they can do?

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The ideal combination for the optical inspection of precision parts with contours, radii, angles.

- SPEEDS INSPECTION
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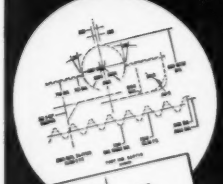
- PROMOTES EFFICIENCY



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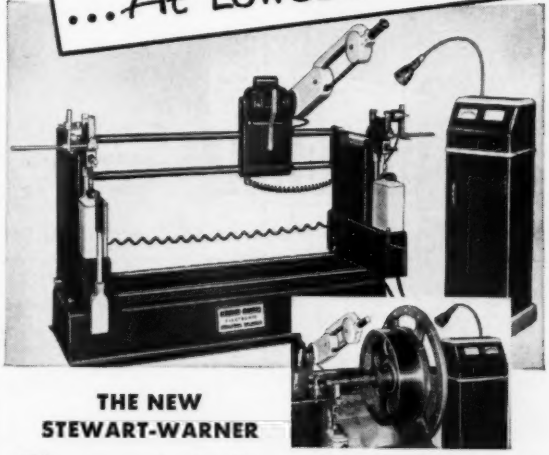
...At Lowest Cost!



THE NEW STEWART-WARNER

Electronic Industrial Balancers

★ 3 models for use in single-piece, short-run or long-run production quantities.

★ Set-up time less than 2 minutes!

★ For balancing a wide range of work on same machine—with no special tooling, coupling devices or accessories needed to change jobs!

The new Stewart-Warner Industrial Balancers not only give you lowest first cost, but cut the cost of balancing *per piece* so low that even smallest shops can now afford their own precision balancing equipment! Handle single-piece, short-run and long-run production, as well as maintenance of your own machines. Semi-skilled workers can learn to operate them in one day! Extremely versatile, sturdy, accurate, engineered for years of service.

Only the Stewart-Warner Balancers Offer These Maximum and Minimum Ranges:

	Weight Range	Diametral Range	Length Range	Sensitivity
Model 704	½ lb. to 1000	½" to 44"	4½" to 55"	0.01 inch-oz.
Model 708 Portable	1 lb. to 5000	1" to 68"	7" to 83"	0.04 inch-oz.

In-place balancing of all rotating machinery.

Write for FREE illustrated brochure on industrial balancing

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STEWART-WARNER CORPORATION

Stewart-Warner Corporation, Dept. F-116
1834 Diversey Parkway, Chicago 14, Illinois
Please mail me all the facts about Stewart-Warner Industrial Balancers.

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Company.....

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City..... Zone..... State.....

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Time and Time Again

Wardwell's 57 T, Circular Saw Grinder, will sharpen as many as 250 Milling Cutters, Slitting and Screw Slitting Saws .015" thick at one time with a variation, plus or minus .001" of exact diameter for entire lot. Automatically indexes the gang of saws, one row of teeth at a time. Steady, accurate, durable. Grind either wet or dry. A time and money saver.

Also can be arranged to feed the grinding wheel into the work without attention of the operator.

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WARDWELL MANUFACTURING CO.

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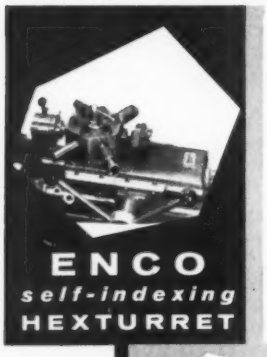
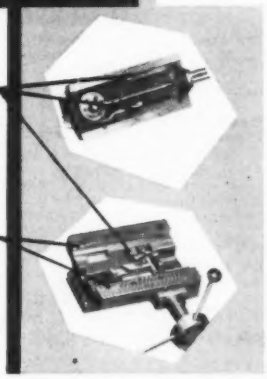
Maker of Largest Line of Saw and Tool Sharpening Machines

CIRCLE INFORM-A-GRAM KEY NO. 2061

how DOUBLE means constant accuracy!



Enco Hexturret accuracy at work. A close tolerance shoulder screw job held to plus .002; minus .000.



Double Drive An Enco exclusive! Twin steel gears and racks equalize feed of tool on work, prevent twisting, assure precision.

Double Gibs Heavy duty type with close adjustment for maintaining constant accuracy.

- Custom-built to fit all-lathes from 9" to 16".
- All bearing surfaces hand scraped
- All parts of indexing mechanism hardened to assure accuracy.

There's an ENCO turret for every lathe. Write today for Catalog No. 53.

ENCO

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Chicago 39, Ill. • Dept. 7116

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.0003 HOLE LOCATION IN 1 MINUTE

EDGE FINDERS

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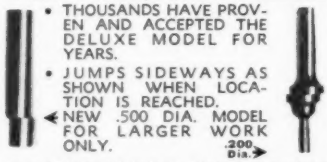

- THOUSANDS HAVE PROVEN AND ACCEPTED THE DELUXE MODEL FOR YEARS.
- JUMPS SIDEWAYS AS SHOWN WHEN LOCATION IS REACHED.
- NEW .500 DIA. MODEL FOR LARGER WORK ONLY.

.200 Dia.

ADJUSTABLE VISE STOP

$2.95

HUNDREDS OF PIECES TO A .0003 TOLERANCE WITH THIS HARDENED VISE STOP THAT IS ADJUSTABLE IN ALL DIRECTIONS. ATTACH TO VISE WITH ONE ¼—20 TAPED HOLE.

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FIXTURE CLAMPS & DETAILS

Heat-treated and Corrosion Resistant

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2092 Woodbine Detroit 39, Mich.
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CIRCLE INFORM-A-GRAM KEY NO. 2064

Trimming Wing Skins by Routing

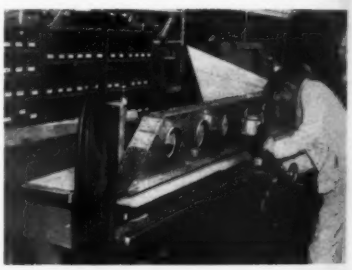
In its tradition of greater and more economical production, Martin Aircraft has developed a new device for trimming panels and trailing edges on the B-57. Prior to this development, the lengthy panels were scribed and cut thus resulting in a subsequent manual filing and finishing operation to the trim line. This method was found to be time-consuming and uneconomical.

THE OLD—An illustration of the outmoded method of trimming wing panels and trailing edges. This procedure involved manual filing in order to trim the rough cut edges of the panels to the finish trim line.

In the new automatic trimming process the panels and trailing edges are placed in the trim fixture; a router is then employed to trim the panels according to their position in the fixture.

The evolution of this method of automatic trimming has cut working time an estimated 60%, resulting in an increased saving.

This tool has now become universal and more tools of this type are being planned to be used on future aircraft models.



THE NEW—A recent tooling addition to the Martin Company operations is the automatic trimming process. The process involves the use of a trim fixture to hold the panel to the scribe line and a router which trims the panels as per their position in the fixture.

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—just a few of the many comments we receive daily about...

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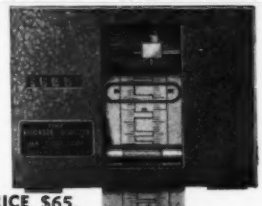

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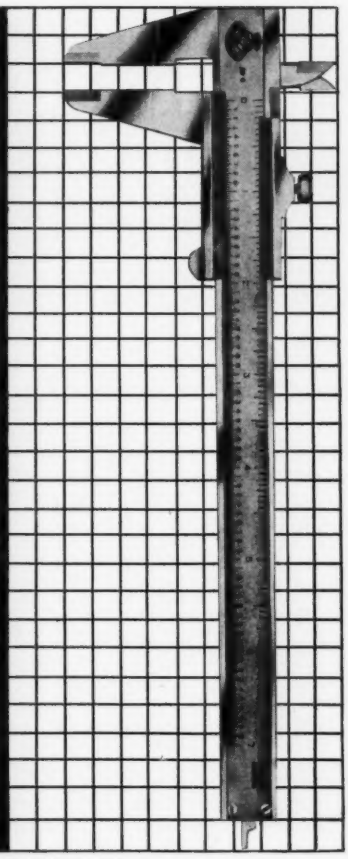

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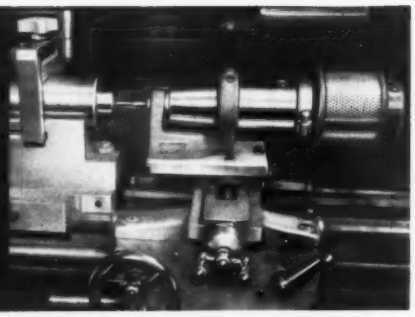

with a *Precise* SUPER 60

Case History M-102

PROBLEM: Internal milling of drill press taper quill 1⅛". Tolerance: TIR on master arbor, .0002" one inch out and .001 four inches out on arbor.

FORMER METHOD: Grinding with tool post grinder. Production — 10 pieces in 5½ hours.

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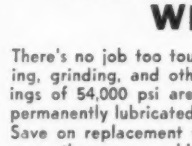

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DRILL PRESS MILLS 45° CHAMFER ON INTERNAL SPLINE

An inexpensive drill press fills in for costly milling machines or internal grinders during short run chamfering operation at International Harvester's Chicago Tractor Works.

Bases of internal splines require a 45° chamfer cut with sufficient precision to avoid stress concentrations. A simple set-up enables the plant to substitute a standard 14" Delta drill press for more complicated equipment or less precise portable tools.

The cut is made by an end mill with a 45° angle. Work is held on a sliding plate by the operator, who controls vertical feed of the drill press with a foot lever. After the spindle is lowered, the operator slides the plate, bringing the spline into contact with the cutter.

Depth of cut is controlled by one manual setting and visual inspection. The sliding plate gives the operator more precise control than if he pushed the piece over a stationary plate.

Rotation from tooth to tooth is done by hand. International Harvester has found that an operator can maintain output with satisfactory precision after little training.

Although a milling machine or internal grinder might do the work more rapidly, special fixtures and setup time make such an operation uneconomic for short runs. Alternatives to using the end mill in the Delta drill press were small grinders or similar hand-held tools.

However, experience has shown that these tools produce less precise chamfers and sometimes notch the work, especially when the operator becomes tired. Notches must be avoided because they are likely to cause stress concentrations, resulting in fractures during heat treatment or in service.

You can easily remove
BROKEN PIPES, STUDS, AND SCREWS
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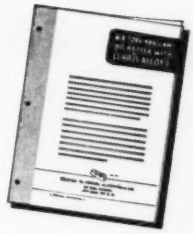

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PERFECT HOLES

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- A NEW MACHINING METHOD! ROTARY BROACHING*
- A NEW NAME-"**ROTARY BROACH**"*

ROTARY BROACHES may be used in lathes, turret lathes, automatics, drill presses, etc., to replace reamers. They produce perfect holes with finishes that can only be compared to honing. They last longer before grinding is necessary and may be resharpened 10 to 30 times. They produce perfect holes at a fraction of the cost of those produced by other methods. Eliminates grinding, lapping, honing and boring.

USE THIS NEW MACHINING METHOD — ROTARY BROACHING*
*"Rotary Broach" & "Rotary Broaching" are new names coined & copyrighted by Shearcut Tool Co.
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CIRCLE INFORM-A-GRAM KEY NO. 2094

Key Men in Multi-Plant Firm Exposed to New Manufacturing Concepts

PROGRESS THROUGH AUTOMATION was the theme of a unique management conference series recently staged at the Manufacturing Research Lab of International Harvester Company. More than 450 manufacturing and engineering executives and department heads from every I-H plant in the United States and Canada, including the company's executive council, were brought in groups of about 50 to the I-H manufacturing research laboratories in Chicago for a two-day program of lectures, tour of the Laboratory's facilities, and study of the many outstanding developments being demonstrated.

Keynoting the conference, R. C. Archer, vice president-manufacturing, said, "Here we will direct your attention to the (more notable) recent advancements in available manufacturing facilities and, more specifically, to the area generally known as Automation . . . . It is apparent that the rapid progress being made in Automation will make it impossible to procure equipment for every possible application where benefit may be derived. This progress may in itself obsolete facilities procured today in an extremely short time. This makes it essential that we keep abreast of the advancing technology and give consideration to this factor in the selection of equipment."

Formal conference room subjects included general orientation in automation, the mechanics of automation, servo and feedback principles, relationship to quality control, movement of materials, and the application of automation to specific areas such as welding and foundry. Films reviewed by the International Harvester key people covered automated grinding, automatic loading devices for machine tools, and trends in modern forging. Speakers included both I-H staff members and executives of leading equipment suppliers.

The company brought industrial suppliers also into the floor demonstrations of the most recent and most outstanding technological advancements. The selection of demonstrations was based largely on the concepts and innovations involved, rather than on the merits of the specific equipment.

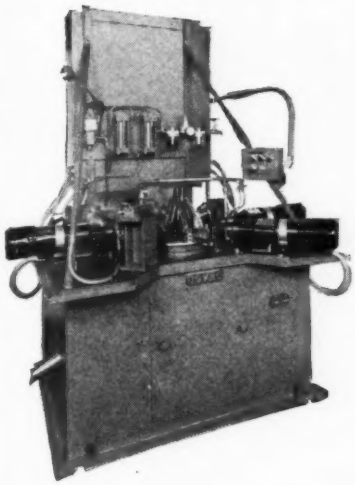
Magnetic tape programmed automatic lathe operations were performed on the Gisholt Factrol hydraulic turret lathe, including one complex job which had required 3 hrs to set up in contrast to 3 days that might have been required by conventional practice. Punch card machine control was demonstrated with the Sundstrand automatic lathe (Model No. 14), using carbide tools for roughing and ceramic tools for finishing.

Automatic work handling techniques were represented by specially equipped Seneca Falls Lo-Swing lathe, Sheffield raceway grinder, Micromatic honer, Foote-Burt continuous broach, and others.

But the big emphasis was on automatic control concepts embodied in programmed machine tools, automatic gaging and sorting, feedback circuits adjusting wheel or tool or table to compensate for variations in work produced, and table positioning by numeric input. Elimination of maintenance problems in electronic machine controls was found in the Westinghouse Cypak, Magnetic Amplifiers, and W. F. and John Barnes Electro-Graphic Detector panel.

Not all of the developments studied by visiting I-H executives directly involved automation or cybernetics. Ultra-fast sharpening of carbide tools was demonstrated on the Method X electrolytic carbide sharpener and the Wesson "Poweramic" grinder with oscillating wheelhead. **Elimination** of tool grinding was the primary benefit pointed out for the throw-away tooling concept, exemplified in a new milling cutter design of Wesson's which was taking a ¼" depth bite from a 1040 steel block at increased speeds and feeds on a Sundstrand Rigid Mill No. 55.

Many of the company's own developments were demonstrated, illustrating the extensive staff services provided by the Manufacturing Research Laboratories. The Progress Through Automation program was a magnificent attempt . . . and a highly successful one . . . to acquaint all key individuals throughout the company with the tremendous surge of development activity that is currently in progress and that will vitally affect manufacturing philosophy and practice in the immediate years ahead. end



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Originally designed for an automotive parts manufacturer to meet the stress of competition and reduce production costs, this machine performs 6 operations on 700 parts per hour — a task that would ordinarily require 6 men and 6 machines.

Incorporating five Govro-Nelson Automatic Drilling Units, together with a power saw, the machine drills, tap drills, taps, taper reams, slots and deburrs the steel part in the order stated. The operator merely clamps the part in the machine. All of the operations, as well as unclamping and ejecting, are performed automatically.

By making changes in the number and arrangement of the drilling units, the machine is readily adaptable to a variety of operations. Send for complete information.

Automatic DRILLING UNIT

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RICE-MILWAUKEE

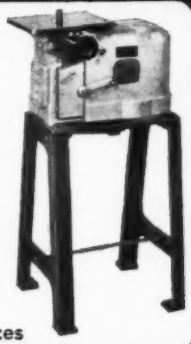
DIE FILERS . . . for straight-line sharp corner filing, sawing and lapping.

This low cost precision-built unit performs all die making operations at savings up to 40%. Furnished complete with motor and two overarms. No extras to buy.

PROFILE GRINDERS

. . . for high speed Precision Grinding of Curved and Irregular Contours.

Standard features include 20,000 or 30,000 R.P.M., or a combination of these spindle speeds, ½ H.P. motor, Collet Chuck, Compound tilting table, built-in wheel dresser.



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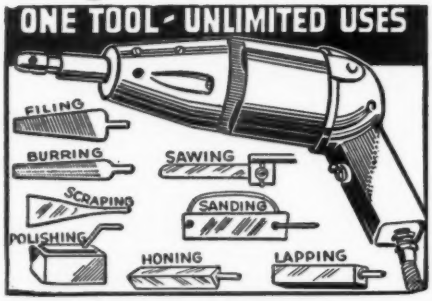
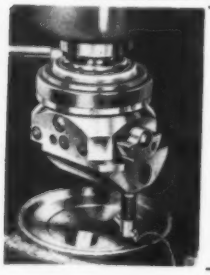
Light in weight — Delivers 1/8" or 3/16" fixed stroke at 1000 strokes per minute — Operates on 110 volts AC or DC.



ACME TOOL COMPANY

75 WEST BROADWAY NEW YORK 7, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 2122



Do you save money with several accuracy jeopardizing set-ups when one set-up could do your work? *We think not!*

BUT . . .

With our WOHLHAUPTER MASTERHEAD IN ONE SET-UP you do boring, facing, recessing, undercutting, turning, etc. on ONE machine and • Save considerable time • Increase production • Increase efficiency • Utilize your present machine park more economically.

9 models of the WOHLHAUPTER MASTERHEAD available with capacities up to 31¾".
All models have automatic feed and automatic end release.
Multiple feed models have 12 slide feeds.

Also Automatic Tapercutting Heads for Angles 0-180°, inside and outside.

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AND THE FOLLOWING IMPROVEMENTS HAVE BEEN ADDED

• HARDENED PHOSPHOR-BRONZE adjustable gib retains accuracy
• SPECIALLY LONG VERNIER to read thousandths
• 3 GRADUATIONS - 1/1000" - 1/128" 1/10 mm in back

$14.75 PPD

Request illustrated folder showing complete line of MAUSER Toolmakers Calipers, Height Gages, Bevel Protractors and Tool Stands.

GEORGE SCHERR CO., Inc.

200-T Lafayette Street • New York 12, New York

CIRCLE INFORM-A-GRAM KEY NO. 2124

Polishing Out Tool Marks from Plastic Molds

Production of plastic parts on which smooth surfaces are specified, requires that the mold surface be free of all tool and grinder marks and have a mirror-like finish.

Preparing the surface of a mold 3' in dia gave the manufacturer of large spherical plastic balls considerable trouble when finishing with the coated abrasives he had been using. The mold was a combination injection-compression plastic mold of aluminum alloy made in two castings — each half weighing 946 lbs.

The blanks were set up on a vertical boring mill and all turning, grinding and polishing operations were performed without disturbing the setup in order to maintain the original shape.

A change-over in abrasives was made, Cratex wheels and blocks being adapted. These rubberized abrasive wheels, manufactured by Cratex Manufacturing Co., 81 Natoma St., San Francisco 5, are slightly flexible and resilient in contrast to wheels having a stone-like hardness. The rubber bond has a cushioned cutting and polishing action, cuts smoothly and softly, without any bouncing or digging in.

In finishing this mold the Cratex coarse grit wheel was mounted on a hand grinder to rough polish without coolant. Then the Cratex coarse grit block was used to finish, and the medium grit block was used for final polish — both blocks by hand. The casting being left set up on the boring mill table, made possible turning it as desired throughout the entire process.

Actual time records show that by these changes the job was performed much faster and a higher mirror finish was attained.

Six Transfer Feed Presses Go to Ford Sterling Plant

Danly Machine Specialties, Inc. has delivered six transfer feed presses to the new Sterling plant of the Ford Motor Company in Warren, Mich.

The two 600-ton, two 1,000-ton and two 2,000-ton presses will be used for drawing and piercing operations on parts used in the balljoint suspension units of Ford and Mercury automobiles.

The presses are built to accommodate up to ten dies, with each die performing a separate operation. Eventually the entire press line will be equipped with automatic handling devices to speed up production and increase efficiency.

FREE... 64 PAGE CATALOG

WORLD'S LARGEST LINE OF WORK HOLDING EQUIPMENT—CHUCK JAW BLANKS, CAST ALUMINUM AND MALLEABLE KNOBS, WHEELS, HANDLES—PLUS HUNDREDS OF OTHER JIG AND FIXTURE COMPONENTS

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Dept. TE-11 712 E. 163rd St., Cleveland 10, Ohio

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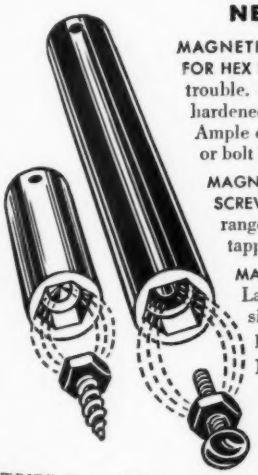
Magna-tip® MAGNETIC SOCKETS

A First Step to Assembly Automation

Speed operations on single or multiple power drivers. Eliminate fumbling and pre-positioning by hand.



NEW! PATENTED!

MAGNETIC BOLT CLEARANCE SOCKETS FOR HEX NUTS—No moving parts to give trouble. Nut held in socket by cup of hardened steel, never touches magnet. Ample clearance for protrusion of stud or bolt beyond nut. U. S. Pat. 2,714,829.

MAGNETIC SOCKETS FOR HEX HEAD SCREWS—Complete size and drive range in proper hardness for self-tapping and sheet metal screws.

MAGNETIC SOCKETS FOR BOLTS—Large range of opening and drive sizes in standard dimensioned power type sockets.

Nut and bolt magnetic sockets available in easy to load surface drive and standard openings.

WRITE Dept. 88-S for manual on the complete line of Magnetic Bit Holders, Finders, Sockets and Hand Screwdrivers. Magna Driver Corp., 779 Washington Street, Buffalo 3, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 2132

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NEW MODEL 70

MULTI-WHEEL NUMBERING MACHINE

The most efficient method of stamping numbers into metal. Repeats the same numbers until changed. Model 70 NUMBERALL Machines are used in all industries to mark various parts. Stamps numbers, etc., quickly . . . neatly. Perfectly aligned. Much better marks are produced by these machines than by single stamps or steel type, and at a far lower cost. Shank for Hand or Press and with any number of wheels from 3 to 20.

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Press shank for foot or power presses

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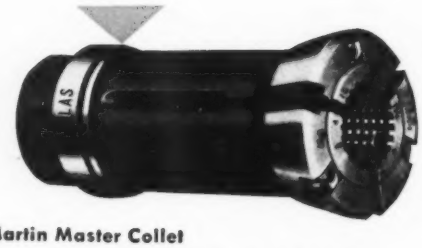

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